

# BGES, INC.

#### SITE CHARACTERIZATION REPORT

TRUMAN PROPERTY PARCEL 2529040120001 OTHELLO, WASHINGTON

#### **JUNE 2021**

Submitted to:

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June 25, 2021 Date



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#### ACRONYMS

ASTM	-	American Society for Testing Materials
BGES	-	Braunstein Geological and Environmental Services
CCV	-	Continuing Calibration Verification
CPG	-	Certified Professional Geologist
CSM	-	Conceptual Site Model
Drayton	-	Drayton Archaeology
DRO	-	Diesel Range Organics
Ecology	-	Washington State Department of Ecology
EDB	-	1,2-dibromoethane
EPA	-	Environmental Protection Agency
ESN	-	Environmental Services Network
GRO	-	Gasoline Range Organics
IDW	-	Investigation-Derived Waste
LCS	-	Laboratory Control Sample
LCSD	-	Laboratory Control Sample Duplicate
LOQ	-	Limit of Quantitation
μg/L	-	Micrograms per Liter
mL/min	-	Milliliters per minute
MS	-	Matrix Spike
PAHs	-	Polycyclic Aromatic Hydrocarbons
PCBs	-	Polychlorinated Biphenyls
PID	-	Photoionization Detector
PPE	-	Personal Protective Equipment
ppm	-	Parts Per Million
QC	-	Quality Control
RL	-	Reporting Limit
RPD	-	Relative Percent Difference
RRO	-	Residual Range Organics
TestAmerica	-	Eurofins TestAmerica Laboratories, Inc.
USACE	-	United States Army Corps of Engineers
VOCs	-	Volatile Organic Compounds
WAC	-	Washington Administrative Code

#### **EXECUTIVE SUMMARY**

On behalf of the City of Othello, BGES, Inc. (BGES) performed a soil and groundwater assessment of parcel 2529040120001, known colloquially as the Truman Property, to evaluate the extent of contamination that was observed during a Phase I Environmental Site Assessment (ESA) in September of 2020. This project was developed to inform the City of Othello of site conditions prior to potentially purchasing the property. BGES advanced 17 shallow soil borings and submitted 8 soil samples for laboratory analysis from the perimeter of the apparently impacted area. Three soil borings were also advanced on the eastern portion of the property to evaluate the potential for contaminant migration from the railroad, and two soil samples (plus a duplicate soil sample) were submitted for laboratory analysis from those borings. No analytes were detected at concentrations exceeding the Washington State Department of Ecology (Ecology) cleanup criteria. Three soil borings near the potentially impacted area were completed as temporary monitoring wells and groundwater samples were collected from the wells for laboratory analysis. Chromium, lead, and nickel were detected in Monitoring Well MW1 at concentrations exceeding the Ecology cleanup criteria.

#### **1.0 INTRODUCTION**

BGES was retained by the City of Othello to conduct characterization activities at the Truman Property in Othello, Washington; hereafter referred to as the subject property (Figure 1). The purpose of the activities described below was to evaluate the extent and type of contamination resulting from apparent dumping of used oil on the subject property. BGES investigated the presence of contamination through the advancement of twenty soil borings and three temporary groundwater monitoring wells. These field activities were performed during May of 2021.

#### 1.1 GENERAL SITE INFORMATION

The Truman Property, Parcel 2529040120001, is owned by the estate of Sharon Truman and is located to the south of West Cunningham Road, east of South Danielle Road, and west of Potholes Canal; in the western portion of Othello, Washington. The subject property is located in the southwestern portion of Adams County. The legal description of the subject property is "W1/2 NE1/4 SEC 4, TWP 15, RGE 29 LESS CANAL R/W & 2.01 AC TO CITY". The subject property is located in the Western Half of the Northeast Quarter, Section 4, Township 15 North, Range 29 East, Willamette Meridian, Washington. Residential neighborhoods are located to the west and south, agricultural land is located to the north, and the Potholes Canal is located to the east. The railroad and the City of Othello are located further to the east.

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			Number		
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Owner	(Attorney for Estate of	Moses Lake, WA			
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This project is being coordinated between the following individuals/organizations:

#### **1.2 SITE HISTORY**

The subject property was purchased by Sharon Truman on December 22, 1997. The previous owner is unknown; however, the Chicago, Milwaukee, St. Paul, and Pacific Railroad Company is believed to be a

past owner. No past uses of the site are known. Based on a review of historical aerial imagery, as discussed in BGES' Phase I ESA dated October 2020; the property has been vacant and undeveloped since at least 1953, with the exception of various unpaved roadways.

What appeared to be free product, stained soils, and stressed vegetation were identified by BGES during the performance of a Phase I ESA, dated October of 2020. These observations were made on the central portion of the subject property.

#### 1.3 SITE USE

The subject property is currently undeveloped and vacant. The City of Othello intends to purchase and develop the property into an industrial wastewater reuse facility and a wildlife wetland enhanced nature park.

The City of Othello applied for and received a grant from the Washington State Department of Ecology (Ecology) Brownfields Program to evaluate the extent and type of contamination on the subject property. This project was also coordinated with the United States Army Corps of Engineers (USACE), who issued a Joint Aquatic Resources Permit for performing the site characterization activities in an identified wetland (Figure 2).

#### 2.0 FIELD INVESTIGATIONS

All field investigations that have been performed to date are summarized in the following sections.

#### 2.1 PREVIOUS ENVIRONMENTAL INVESTIGATIONS

In April of 2021, Drayton Archaeology (Drayton) conducted a cultural resource review of the subject property in an attempt to identify any significant cultural deposits. The assessment included a background review and a pedestrian survey, including a limited subsurface investigation. Drayton did not identify any significant cultural deposits on the subject property. The Cultural Resources Report prepared by Drayton is included in Appendix A.

#### 2.2 SITE CHARACTERIZATION

These site characterization activities were performed by Rose Pollock, who is a Senior Environmental Scientist of BGES and an Environmental Professional as defined by American Society for Testing Materials (ASTM) 1903-19. In preparation of performing the site characterization activities, BGES contacted the Washington Utility Notification Center on April 29, 2021 to request locates for public utilities, and no public utilities were reported to be present on the subject property. The onsite activities were performed on May 11, 2021 in accordance with our work plan dated April 19, 2021 (Appendix B), with the following exceptions:

- Prior to mobilizing to the subject property, BGES requested and received approval from Ali Furmall, the Ecology Project Manager, to install 1-inch diameter well screens instead of 2-inch diameter well screens.
- BGES attempted to collect the groundwater sample from Temporary Monitoring Well MW1 with a bladder pump; however, water was not being eliminated from the pump. After several attempts to troubleshoot the system, BGES contacted Ali Furmall, the Ecology Project Manager, to request approval to utilize a peristaltic pump for the groundwater sampling activities. Verbal approval was acquired, and all of the groundwater samples were successfully collected with a peristaltic pump.
- The purge water was stored in a 16-gallon drum instead of a 55-gallon drum, because of the small quantity generated during the groundwater sampling activities.
- A trip blank for Environmental Protection Agency (EPA) Method 8011 was inadvertently omitted from the sample coolers upon delivery to the laboratory. As such, the potential for cross-contamination of 1,2-dibromoethene (EDB) could not be evaluated; however, EDB was not detected in the soil samples at concentrations exceeding the laboratory's limits of quantitation (LOQs).

Weather conditions on May 11, 2021 were sunny, with a temperature of approximately 72 degrees Fahrenheit. The following paragraphs discuss the results of the field activities.

#### 2.2.1 SOIL SAMPLING

Environmental Services Network (ESN) was contracted to advance 20 soil borings throughout the subject property, as directed by BGES. Seventeen soil borings were advanced in a generally circular pattern surrounding the areas of free product, stained soils, and stressed vegetation that were identified during the Phase I ESA; and three soil borings were advanced on the eastern portion of the subject property to evaluate the potential for contamination to be migrating onsite from the railroad. The approximate soil boring locations are depicted on Figures 3 and 4. The soil types were recorded in the field notes, which are included in Appendix C.

Heated headspace samples were collected for field-screening from each soil interval. A photoionization detector (PID) that was calibrated with 100 parts per million (ppm) isobutylene calibration gas prior to use was used to screen each sample. Upon collection, each screening sample was labeled with a unique sample number and the time of collection, then agitated for 15 seconds and warmed to at least 40 degrees Fahrenheit for 10 to 60 minutes. The sample was then agitated again for 15 seconds and the probe of the

PID was inserted into the bag. The maximum PID reading associated with each sample was recorded in the field notebook. The PID readings ranged from 0 ppm to 0.2 ppm. None of the samples exhibited visual or olfactory evidence of contamination. Laboratory samples were collected at random from half of the soil borings, including two samples that exhibited PID readings of 0.2 ppm and three samples that exhibited PID readings of 0.1 ppm.

Samples were collected in laboratory-supplied containers using clean, new, stainless-steel spoons. Sample portions scheduled to be analyzed for volatile compounds were collected first using terracore sampling devices and were immediately preserved with methanol provided by the laboratory. Sample portions scheduled to be analyzed for non-volatile compounds were placed directly in unpreserved laboratory-supplied containers. A duplicate sample was collected from Soil Boring SB20. The samples were immediately placed in a cooler with ice to maintain a temperature of 0 to 6 degrees Celsius. As an additional quality-control measure, one trip blank accompanied the soil samples during the entire sampling and handling process. Samples were labeled, kept in chilled coolers, and hand-delivered by BGES to Eurofins TestAmerica Laboratories, Inc. (TestAmerica) in Tacoma, Washington; an Ecology-approved laboratory, under standard chain of custody protocol.

Upon completion of these soil sampling activities, all soil cuttings and field-screening soil samples were placed in a 16-gallon drum that was labeled as containing "potentially-contaminated soil" with contact information for the City of Othello; and the soil borings were backfilled with clean pea gravel. The decontamination water was placed in a 16-gallon drum that was labeled as containing "potentially-contaminated water" with contact information for the City of Othello. Investigation-derived waste (IDW) also included miscellaneous personal protective equipment (PPE), which was disposed of as municipal waste.

During performance of the soil sampling activities, Shawn Logan, the Mayor of Othello, visited the site and observed an unidentified material embedded in the ground surface at two distinct locations (Figure 2). A sample was collected but was ultimately not submitted to the laboratory, because the product was identified to be asphalt during sample collection, and it was determined that analytical data would not provide useful information.

#### 2.2.2 GROUNDWATER SAMPLING

ESN installed temporary monitoring wells in three soil borings (Figure 5). Each monitoring well consisted of a 1-inch diameter, pre-packed well screen coupled to riser pipe, such that a minimum of 2 feet of water was present within each well for sampling. The depth to water and the total depth of each monitoring well

were measured using an electronic water level indicator that was decontaminated prior to insertion in each well. The tops of each well were then surveyed to the nearest 0.01 foot to allow for measurement of groundwater elevation contours (Figure 6). These measurements are presented in Table 1.

Each monitoring well was purged for approximately 5 to 10 minutes and then sampled using a peristaltic pump equipped with new polyethylene and silicone tubing. The flow rate during purging and sampling was between 50 and 300 milliliters per minute (mL/min). The purge water was temporarily collected in 5-gallon buckets. After approximately one well volume had been purged from each well, water samples were collected directly into laboratory-supplied containers. The samples for volatile analyses were collected first and care was exercised to ensure that no headspace remained, and that none of the preservative was spilled from the containers. Samples for metals analyses were not filtered. One duplicate sample was collected from Temporary Monitoring Well 1 and was labeled MW2 such that it would be submitted "blindly" to the laboratory. As an additional quality-control measure, one trip blank accompanied the groundwater samples during the entire sampling and handling process. The sample containers were labeled, placed in a cooler with ice to maintain a temperature of 0 to 6 degrees Celsius, and were hand-delivered by BGES to TestAmerica in Tacoma, Washington; an Ecology-approved laboratory, under standard chain of custody protocol.

No visual or olfactory evidence of contamination was observed during these sampling activities. Upon completion of the sampling activities, purge water was combined with the decontamination water in the 16-gallon drum, described above.

After collection of the groundwater samples, the monitoring wells were extracted from the ground by pulling out the well screens and casings. The soil borings were then backfilled using clean pea gravel. IDW, including miscellaneous PPE and monitoring well materials, were disposed of as municipal waste.

Utilizing the measured depths to water and the monitoring well elevations, the groundwater elevations in each of the three monitoring wells were calculated. Then the calculated groundwater elevations for the subject property were utilized to create a groundwater elevation contour map which suggests that groundwater flows in a northwesterly direction (Figure 6) at an approximate hydraulic gradient of 0.01 foot per linear foot.

#### 2.3 SAMPLING/ANALYTICAL RESULTS

Laboratory analyses of the samples collected during these sampling activities were performed by TestAmerica; an Ecology-approved laboratory. Analytical methods are presented in Table 2, analytical results are presented in Tables 3 and 4, and the laboratory data are provided in Appendix D.

The soil and groundwater samples were analyzed for gasoline range organics (GRO) by Method NWTPH-Gx; diesel range organics (DRO) and residual range organics (RRO) by Method NWTPH-Dx; volatile organic compounds (VOCs) by EPA Method 8260D (low-level for water samples); EDB by EPA Method 8011; cadmium, chromium, lead, nickel, and zinc by EPA Method 6020B; polychlorinated biphenyls (PCBs) by EPA Method 8082A; and polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8270E-SIM. As a quality control procedure, one soil and one groundwater trip blank sample accompanied the sample portions scheduled for volatile analyses at all times from sample collection until submission to the laboratory, and were analyzed by the same methods listed above for GRO and VOCs, to determine the potential for cross-contamination of the samples to have occurred.

The following is a review of the quality of the laboratory analytical data, and a summary of the analytical results for the soil and groundwater samples.

#### 2.3.1 QUALITY ANALYSES

Data quality was reviewed in accordance with Ecology guidance and standard industry practices. The following is a discussion of our evaluation of sample conditions and laboratory procedures for the samples collected on May 11, 2021.

The soil samples contained the proper preservatives for the requested analyses and no unusual sample conditions were noted by the laboratory. The temperatures within the sample coolers were measured at the Eurofins TestAmerica laboratory in Tacoma, Washington at the time of receipt to be 2.6 and 5.4 degrees Celsius. The samples were then shipped to the Eurofins TestAmerica laboratory in Spokane, Washington, and the temperatures of the sample coolers were measured at the time of receipt to be 1.0 and 0.8 degree Celsius.

The Eurofins TestAmerica laboratories in Tacoma and Spokane are Washington State-accredited laboratories. The laboratory performed the correct analyses as indicated on the chain of custody, and all analyses were performed within the prescribed holding times. The groundwater sample identification numbers were incorrectly logged by the laboratory (eg MW-1-0511 instead of MW1-0511) and a revised laboratory report was issued after the correction was made. Duplicates, matrix spikes, and laboratory control samples were analyzed at the proper frequencies, and control limits were met except as noted below. A case narrative was provided by the laboratory and the following data quality issues were identified.

The recoveries of GRO within the continuing calibration verification samples (CCVs) for soil and groundwater exceeded the laboratory acceptance criteria; indicating a potential for the reported

concentrations of GRO to be biased high within the associated project samples. GRO was not detected in the associated soil or groundwater samples, and the reporting limits (RLs) for GRO were less than the Ecology cleanup criterion. For this reason, it is our opinion that this data quality control (QC) failure does not affect our interpretation of the data for their intended use.

The recoveries of chlorodibromomethane, bromoform, and trichlorofluoromethane within the CCV associated with the groundwater samples exceeded the laboratory acceptance criteria, indicating a potential for the reported concentrations of these analytes to be biased high within the associated project samples. However, because these analytes were not detected at the RLs within these samples, and because the RLs are less than the Ecology cleanup criteria for these analytes; it is our opinion that this data QC failure does not affect our interpretation of the data for their intended use.

The recoveries of carbon tetrachloride, dichlorobromomethane, chlorodibromomethane, dichlorodifluoromethane, 1,1-dichloroethene, bromoform, and trichlorofluoromethane within the laboratory control sample (LCS) and/or LCS Duplicate (LCSD) associated with the groundwater samples exceeded the laboratory acceptance criteria, indicating a potential for the reported concentrations of these analytes to be biased high within the associated groundwater samples. However, because these analytes were not detected at the RLs within these samples, and because the RLs are less than the Ecology cleanup criteria for these analytes; it is our opinion that this data QC failure does not affect our interpretation of the data for their intended use.

The pH of Sample MW4-0511 associated with VOC analyses exceeded laboratory acceptance criteria, indicating a potential for preservative loss or sample matrix interference. However, because the sample was analyzed within the prescribed holding time for an unpreserved sample, it is our opinion that this data QC failure does not affect our interpretation of the data for their intended use.

The recovery of vinyl chloride within the CCV associated with Sample MW1-0511 exceeded the laboratory acceptance criteria, indicating a potential for the reported concentration of this analyte to be biased high within the associated project sample. However, because vinyl chloride was not detected at the RL in Sample MW1-0511, and because the RL is an order of magnitude less than the Ecology cleanup criterion for this analyte; it is our opinion that this data QC failure does not affect our interpretation of the data for their intended use.

The relative percent difference (RPD) between the reported concentrations of pyrene within the LCS and LCSD exceeded laboratory acceptance criteria, indicating a potential for the reported concentrations of this analyte to be biased within the associated groundwater samples. However, because pyrene was not

detected at the RLs in the groundwater samples, and because the RLs are more than three orders of magnitude less than the Ecology cleanup criterion for this analyte; it is our opinion that this data QC failure does not affect our interpretation of the data for their intended use.

Fluoranthene, fluorene, indeno[1,2,3-cd]pyrene, and benzo[a]pyrene were detected in the Method Blank associated with the groundwater samples; indicating potential laboratory contamination, and potentially rendering the concentrations of these analytes as biased high. For this reason, the reported concentrations of fluoranthene and fluorene (the only PAH analytes that were detected) within the groundwater samples are qualified with a "J" in Table 4 and should be considered estimates. However, because these analytes were either detected at concentrations less than the Ecology cleanup criteria or were not detected at the RLs, and because the RLs are less than the Ecology cleanup criteria for these analytes; it is our opinion that this data QC failure does not affect our interpretation of the data for their intended use.

The recovery of surrogate nitrobenzene-d5 associated with PAH analysis in Sample MW3-0511 exceeded the laboratory acceptance criteria, indicating a potential for the reported concentrations of the associated PAHs to be biased high within this sample. For this reason, the detected concentration of fluorene (the only PAH analyte detected in this sample) within this sample is qualified with a "J" in Table 4 and should be considered an estimate. However, because fluorene was detected at a concentration less than the Ecology cleanup criterion for this analyte, and because no other PAHs were detected at the RLs in Sample MW3-0511, and because the RLs were less than the Ecology cleanup criteria; it is our opinion that this data QC failure does not affect our interpretation of the data for their intended use.

The recovery of surrogate nitrobenzene-d5 associated with PAH analysis in Sample SB13-1-0511 was less than the laboratory acceptance criteria, indicating a potential for the reported concentrations of the associated PAHs to be biased low within this sample. However, because no PAHs were detected at the RLs in this sample, and because the RLs were less than the Ecology cleanup criteria; it is our opinion that this data QC failure does not affect our interpretation of the data for their intended use.

The recovery of EDB within the Matrix Spike (MS) associated with the soil and groundwater samples was less than the laboratory acceptance criteria, indicating a potential for the reported concentrations of this analyte to be biased low in the associated samples. However, because this analyte was not detected at the RLs in the associated project samples, and because the RLs were at least one order of magnitude less than the Ecology cleanup criterion for this analyte; it is our opinion that this data QC failure does not affect our interpretation of the data for their intended use.

Sample SB20-2-0511 is a duplicate of Sample SB20-1-0511 and was collected to evaluate field sampling precision. The RPDs between the reported concentrations of cadmium, chromium, lead, nickel, and zinc ranged from 3 to 23 percent; indicating relatively good field sampling precision with respect to these analytes. The RPDs between the reported concentrations of the remaining analytes in these samples could not be calculated because the analytes were not detected in one or both of the samples.

Sample MW2-0511 is a duplicate of Sample MW1-0511 and was collected to evaluate field sampling precision. The RPDs between the reported concentrations of cadmium, chromium, lead, nickel, and zinc ranged from 24 to 31 percent; indicating relatively good field sampling precision with respect to these analytes. The RPDs between the reported concentrations of the remaining analytes in these samples could not be calculated because the analytes were not detected in one or both of the samples.

#### 2.3.2 SOIL SAMPLE RESULTS

The soil samples were labeled, for example, SB1-1-0511, where the prefix "SB1" indicates the soil boring location from which the soil sample was collected; "-1" indicates the interval associated with the soil sample; and "0511" indicates the month and day the sample was collected.

A total of 11 samples were collected from the soil borings and submitted to the laboratory for analysis, including one duplicate sample. The soil sample results are compared to the values listed in Washington Administrative Code (WAC) 173-340-900 (October 25, 2019), Method A values for unrestricted land use for GRO, DRO, RRO, EDB, VOCs, PAHs, PCBs, cadmium, chromium, and lead; and Method B values for nickel and zinc. Method A values were chosen, when available, because relatively few analytes were detected in the soil samples and Method A values were available for all of the analytes that were detected except nickel and zinc.

DRO, RRO, naphthalene, PCB-1260, cadmium, chromium, lead, nickel, and zinc were detected in the samples at concentrations less than the Ecology cleanup criteria. No analytes were detected in the soil samples at concentrations exceeding the Ecology cleanup criteria. Analytical results for the soil samples are summarized in Table 3; the laboratory analytical results are included in Appendix D; and the sample locations and PID screening results are shown on Figures 3 and 4.

#### 2.3.3 GROUNDWATER SAMPLE RESULTS

The groundwater samples were labeled, for example, MW1-0511, where the prefix "MW1" indicates the temporary monitoring well location from which the groundwater sample was collected; and "0511" indicates the month and day the sample was collected.

A total of four samples were collected from the temporary monitoring wells, including one duplicate sample. The groundwater sample results are compared to the values listed in WAC 173-340-900 (October 25, 2019).

Samples MW1-0511 and duplicate sample MW2-0511 exhibited maximum chromium concentrations of 150 micrograms per liter ( $\mu$ g/L), which exceeds the Ecology cleanup criterion of 50  $\mu$ g/L; maximum lead concentrations of 68  $\mu$ g/L, which exceeds the Ecology cleanup criterion of 15  $\mu$ g/L; and maximum nickel concentrations of 180  $\mu$ g/L, which exceeds the Ecology cleanup criterion of 100  $\mu$ g/L. DRO, RRO, 1,2-dichlorobenzene, toluene, 1-methylnaphthalene, 2-methylnaphthalene, acenaphthylene, fluoranthene, fluorene, naphthalene, cadmium, chromium, lead, nickel, and zinc were detected in one or more samples at concentrations less than the Ecology cleanup criteria. Analytical results for the groundwater samples are summarized in Table 4; the laboratory analytical results are included in Appendix D; and the groundwater sample locations and sample results are shown on Figure 5.

#### **3.0 CONCEPTUAL SITE MODEL**

Stained soils, free product, and stressed vegetation were observed on the central portion of the project site during BGES' Phase I ESA site reconnaissance in September of 2020. Although it may be speculated that the contamination stems from unauthorized dumping, the specific source of contamination is not known. It is also unknown when the release occurred. Additionally, samples have not been collected from the most impacted area. While BGES was onsite to perform the site characterization activities described above, stained soils and free product were not visible, although stressed vegetation was observed.

A graphic conceptual site model (CSM) detailing various potential exposure media, transport mechanisms, exposure pathways, and receptors for identified contamination at this site was prepared and is included as Figure 7. The media identified at the site to which the contamination was directly released is surface soils and surface water. The transport mechanisms through which contamination could have mobilized were identified to be migration to subsurface soils, migration to groundwater, volatilization to air, runoff or erosion, and uptake by plants or animals.

Potential exposure pathways through which contamination at this site could impact potential current and/or future human receptors were identified to be incidental ingestion of soils, groundwater, and surface water; dermal absorption of contaminants through contact with soils, groundwater, and surface water; inhalation of fugitive dust, outdoor air, volatile compounds in tap water (future receptors), and volatile compounds in indoor air (future receptors); direct contact with sediments; and ingestion of wild or farmed foods.

Potential current and/or future human receptors for this site were identified to be residents, commercial or industrial workers, site visitors and trespassers, construction workers, and farmers or subsistence harvesters and consumers.

#### 4.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Eleven subsurface soil samples (including one duplicate sample) were collected during the soil investigation activities. No contamination was identified in any of the soil samples at concentrations exceeding the Ecology cleanup criteria.

Four water samples (including one duplicate sample) were collected during the groundwater investigation activities. Chromium, lead, and nickel were detected at concentrations exceeding the Ecology cleanup criteria in Monitoring Well MW1.

Based on our observations during the Phase I ESA site reconnaissance in October of 2020 and the results of this limited Phase II ESA, the impacted area may consist of approximately 600 to 1,600 cubic yards of contaminated soil. The estimated costs to remediate the site are presented in the following table, based on these two scenarios.

Task	'Low End' Scenario (assuming	'High End' Scenario (assuming		
	600 cubic yards)	1,600 cubic yards)		
Work Plan	\$1,700	\$1,700		
Excavation	\$12,000	\$24,000		
Soil Transportation & Disposal	\$108,000	\$270,000		
Laboratory Analyses	\$23,000	\$50,000		
Report	\$9,000	\$12,000		
Totals	\$153,700	\$357,700		

These estimated costs are based on the following assumptions:

- The excavation would require two field days in the 'low end' scenario and five field days in the 'high end' scenario;
- The contaminated soil would be accepted by the Anderson Rock and Demolition Pit in Yakima, Washington;
- As recommended in Ecology's Guidance for Remediation of Petroleum Contaminated Sites (June

2016), one sample for laboratory analysis will be collected per 20 linear feet of sidewall, and one sample for laboratory analysis will be collected per 400 square feet of base area; and,

• The soil samples will be submitted to a Washington-approved laboratory for analysis of GRO, DRO, RRO, VOCs, EDB, PAHs, PCBs, cadmium, chromium, lead, nickel, and zinc.

#### 5.0 EXCLUSIONS AND CONSIDERATIONS

This report presents facts, observations, and inferences based on conditions observed during the period of our project activities, and only those conditions that were evaluated as part of our scope of work. Our conclusions are based solely on our observations made and work conducted, and only apply to the immediate vicinities of the locations where the soil samples were collected. In addition, changes to site conditions may have occurred since the completion of our project activities. These changes may be from the actions of man or nature. Changes in regulations may also impact the interpretation of site conditions. BGES will not disclose our findings to any parties other than our client as listed above, except as directed by our client, or as required by law.

The field activities were completed by Rose Pollock, Senior Environmental Scientist of BGES. Ms. Pollock has more than 7 years of environmental consulting experience and has conducted numerous site characterization projects throughout the Pacific Northwest. This report was prepared by Ms. Pollock and was reviewed by Robert N. Braunstein, Certified Professional Geologist (CPG) and Principal of BGES. Mr. Braunstein is a Registered Professional Geologist in Washington State (No. 3305) has more than 40 years of professional environmental and geological consulting experience and has conducted and managed thousands of environmental projects involving site characterization and remediation efforts throughout the United States.

#### 6.0 **REFERENCES**

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Sincerely,

#### **BGES, INC.**

Field Work Performed and Report Prepared by:

Con SPallall

Rose Pollock Senior Environmental Scientist

Report Reviewed by:

Robert h. Broumstern

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Image Layers Courtesy of USGS and US Fish and Wildlife Service















#### TABLE 1 TRUMAN PROPERTY OTHELLO, WASHINGTON MONITORING WELL DATA (MAY 2021)

Well Number	MW1	MW3	MW4
Date Sampled	05/11/21	05/11/21	05/11/21
Date of Depth and Elevation Measurement	05/11/21	05/11/21	05/11/21
Time of Depth to Water Measurement	11:56	14:04	17:06
Time Sample Collected	12:06	14:15	17:16
Top of Casing Elevation (feet)	96.61	96.32	95.72
Depth to Water (feet below top of casing)	1.20	1.75	1.68
Water Elevation (feet)	95.41	94.57	94.04
Total Depth of Well (feet below top of casing)	5.11	5.06	5.17
Ground Elevation	96.33	96.74	95.44
Depth to Water (feet below top of ground surface)	0.92	2.17	1.40
Well Casing Diameter (Inches)	1	1	1
Standing Water Well Volume (gallons)	0.16	0.14	0.14
Purge Volume (gallons)	5	5	5
Temperature (degrees Celsius)	N/A	N/A	N/A
Conductivity (millisiemans per centimeter)	N/A	N/A	N/A
pH (standard units)	N/A	N/A	N/A
Oxidation Reduction Potential (millivolts)	N/A	N/A	N/A
Notes: Weather conditions on May 11, 2021 were sunny with an ambient temperature of 72 degrees Fahrenheit.	Duplicate Sample MW2-0511 was collected at 12:19.		

## TABLE 2TRUMAN PROPERTYOTHELLO, WASHINGTONSAMPLING INFORMATION / LABORATORY METHODS

Contaminants of Concern	Sampling Methods	<b>Analytical Methods</b>	Reporting Limits		
			Soil Samples	Water Samples	
			(mg/Kg)	(µg/L)	
Gasoline Range Organics (GRO)		NWTPH-Gx	5.00	150	
Diesel Range Organics (DRO)		NWTPH-Dx	10.0	240	
Residual Range Organics (RRO)		NWTPH-Dx	25.0	400	
1-2-dibromoethane (EDB)		8011	0.0800	0.0100	
Benzene		8260D	0.0200	0.200	
Ethylbenzene		8260D	0.100	0.200	
Toluene		8260D	0.100	0.200	
Total Xylenes	Direct Push / Macro	8260D	0.600	1.000	
All other volatile organic compounds (VOCs)	Core Sampler	8260D	varies	varies	
Polynuclear aromatic hydrocarbons (PAHs)		8270E-SIM	0.0100	0.0900	
Polychlorinated biphenyls (PCBs)		8082A	0.0100	0.100	
Cadmium		6020B	0.800	2.00	
Chromium		6020B	1.00	4.00	
Lead		6020B	0.500	2.00	
Nickel		6020B	0.500	15.0	
Zinc		6020B	5.50	35.0	

Sample	Parameter	Results		RL (mg/Kg)	MDL	Ecology Cleanup	Analytical Method
•		(mg/Kg)			(mg/Kg)	Criteria <sup>1</sup> (mg/Kg)	·
SB1-1-0511	GRO	ND		6.9	2.5	30	NWTPH-Gx
Depth = 0 to 2 feet	DRO	ND		12	5.1	2,000	NWTPH-Dx
PID = 0 ppm	RRO	8.3	J	30	6.0	2,000	NWTPH-Dx
	Benzene	ND		0.027	0.014	0.03	8260D
	Ethylbenzene	ND		0.14	0.022	6	8260D
	Naphthalene	0.050	J	0.27	0.038	5	8260D
	Toluene	ND		0.14	0.018	7	8260D
	Total Xylenes	ND		0.82	0.071	9	8260D
	1,2-dibromoethane (EDB)	ND		0.000095	0.000042	0.005	8011
	All Other VOCs	ND		varies	varies	varies	8260D
	All PAHs	ND		0.012	varies	varies	8270E-SIM
	All PCBs	ND		0.012	0.0026	1	8082A
	Cadmium	0.076	J	0.65	0.062	2	6020B
	Chromium <sup>2</sup>	15		0.81	0.051	19	6020B
	Lead	6.6		0.40	0.039	250	6020B
	Nickel	15		0.40	0.16	1 600	6020B
	Zinc	42		4 4	13	24 000	6020B
SR2-1-0511	GRO	ND		6.7	2.4	30	NWTPH-Gy
Depth = 0 to 2 feet	DRO	ND		13	5.2	2 000	NWTPH-Dx
PID = 0.1  nnm	PPO	67	т	21	6.3	2,000	NWTPH Dy
FID = 0.1 ppin	RAU	0.7 ND	J	0.027	0.5	2,000	8260D
	Ethylhonzon e			0.027	0.013	0.03	8200D
	Ethylbenzene	ND		0.13	0.022	0 7	8200D
	Totuene	ND		0.13	0.018	/	8200D
		ND		0.80	0.069	9	8200D
	1,2-dibromoethane (EDB)	ND		0.00010	0.000044	0.005	8011
	All Other VOCs	ND		varies	varies	varies	8260D
	All PAHs	ND		0.012	varies	varies	8270E-SIM
	All PCBs	ND		0.012	0.0027	l	8082A
	Cadmium	0.074	J	0.53	0.051	2	6020B
	Chromium <sup>2</sup>	14		0.67	0.042	19	6020B
	Lead	5.9		0.33	0.032	250	6020B
	Nickel	14		0.33	0.13	1,600	6020B
	Zinc	41		3.7	1.1	24,000	6020B
SB3-1-0511	GRO	ND		7.0	2.5	30	NWTPH-Gx
Depth = 0 to 2 feet	DRO	660		12	5.2	2,000	NWTPH-Dx
PID = 0.2 ppm	RRO	960		31	6.2	2,000	NWTPH-Dx
	Benzene	ND		0.028	0.014	0.03	8260D
	Ethylbenzene	ND		0.14	0.023	6	8260D
	Toluene	ND		0.14	0.019	7	8260D
	Total Xylenes	ND		0.84	0.072	9	8260D
	1,2-dibromoethane (EDB)	ND		0.00010	0.000044	0.005	8011
	All Other VOCs	ND		varies	varies	varies	8260D
	All PAHs	ND		0.025	varies	varies	8270E-SIM
	PCB-1260	0.0098	J	0.012	0.0027	1	8082A
	All Other PCBs	ND		0.012	0.0027	1	8082A
	Cadmium	0.074	J	0.77	0.074	2	6020B
	Chromium <sup>2</sup>	15		0.96	0.061	10	6020B
	Lead	50		0.90	0.001	250	6020B
	Nickel	J.9 14		0.40	0.040	∠ <i>3</i> 0 1.600	60200
	Zino	14 12		0.40 5 2	1.19	24 000	6020D
	ZIIIU	42		5.5	1.0	24,000	0020B

SB6-1-0511         GRO         ND         7.0         2.5         30         NNTPH-Gx           PID = 0 ppm         RRO         15         J         31         6.2         2,000         NWTPH-Dx           PID = 0 ppm         RRO         15         J         31         6.2         2,000         NWTPH-Dx           Benzene         ND         0.14         0.023         6         8260D           Toluene         ND         0.14         0.023         6         8260D           1.2-dibromoethane (EDB)         ND         0.0010         0.000045         0.005         8011           All PAHs         ND         0.013         varies         varies         8270E-SIM           All PCBs         ND         0.012         0.0027         1         8082A           Cadmium         ND         0.92         0.089         2         6020B           Lead         6.9         0.58         0.055         250         6020B           Nickel         17         0.58         0.22         1,600         6020B           Lead         6.9         0.58         0.25         2,000         NWTPH-Dx           PID = 0 to 2 feet         DRO	Sample	Parameter	Results (mg/Kg)		RL (mg/Kg)	MDL (mg/Kg)	Ecology Cleanup Criteria <sup>1</sup> (mg/Kg)	Analytical Method
Depth = 0 to 5 feet         DRO         ND         12         5.2         2,000         NWTPH-Dx           PID = 0 ppm         RRO         15         J         31         6.2         2,000         NWTPH-Dx           Benzene         ND         0.028         0.014         0.023         6         8260D           Ethylbenzene         ND         0.14         0.023         6         8260D           Total Xylenes         ND         0.14         0.023         6         8260D           All Other VOCs         ND         0.44         0.072         9         8260D           All PAHs         ND         0.00010         0.000045         0.005         8011           All PCBs         ND         0.013         varies         varies         8270F-SIM           All PCBs         ND         0.012         0.0027         1         8082A           Cadmium         ND         0.92         0.089         2         6020B           Lead         6.9         0.58         0.055         250         6020B           Zinc         49         6.3         1.9         24,000         6020B           Zinc         AD         0.12         <	SB6-1-0511	GRO	ND		7.0	2.5	30	NWTPH-Gx
PID = 0 ppm         RRO         15         J         31         6.2         2,000         NWTPH-Dx           Benzene         ND         0.028         0.014         0.03         8260D           Ethylbenzene         ND         0.14         0.019         7         8260D           Total Xylenes         ND         0.14         0.019         7         8260D           1, 2-dibromoethane (EDB)         ND         0.00010         0.000045         0.005         8011           All PAHs         ND         0.013         varies         varies         8270E-SIM           All PCBs         ND         0.012         0.0027         1         8082A           Cadmium         ND         0.92         0.089         2         6020B           Lead         6.9         0.58         0.025         250         6020B           Nickel         17         0.58         0.22         1,600         6020B           Benzene         ND         0.12         0.012         0.03         8260D           Vickel         17         0.58         0.22         1,600         6020B           Benzene         ND         0.12         0.012         0.03	Depth = 0 to 5 feet	DRO	ND		12	5.2	2,000	NWTPH-Dx
Benzene         ND         0.028         0.014         0.03         8260D           Ethylbenzene         ND         0.14         0.023         6         8260D           Toluene         ND         0.14         0.019         7         8260D           Total Xylenes         ND         0.84         0.072         9         8260D           1.2-dibromochane (EDB)         ND         0.00010         0.00045         0.005         8011           All Other VOCs         ND         varies         varies         varies         8270E-SIM           All PAHs         ND         0.013         varies         varies         8270E-SIM           Cadmium         ND         0.92         0.089         2         6020B           Cadmium         ND         0.92         0.089         2         6020B           Lead         6.9         0.58         0.055         250         6020B           Nickel         17         0.58         0.22         1,600         6020B           Zine         49         6.3         1.9         24,000         6020B           PID = 0.1 pm         RRO         36         31         6.1         2,000         NWTPH-	PID = 0 ppm	RRO	15	J	31	6.2	2,000	NWTPH-Dx
Ethylbenzene         ND         0.14         0.023         6         8260D           Totalene         ND         0.14         0.019         7         8260D           Total Xylenes         ND         0.84         0.072         9         8260D           1.2-dibromoethane (EDB)         ND         0.00010         0.000045         0.005         8011           All PAHs         ND         0.012         varies         varies         8260D           All PCBs         ND         0.012         0.0027         1         8082A           Cadmium         ND         0.92         0.089         2         6020B           Chromium <sup>2</sup> 17         1.2         0.073         19         6020B           Lead         6.9         0.58         0.055         250         6020B           Zinc         49         6.3         1.9         24.000         6020B           Depth = 0 to 2 feet         DRO         6.8         J         12         5.2         2,000         NWTPH-5x           PID = 0.1 ppm         RRO         36         31         6.1         2,000         NWTPH-5x           PID = 0.1 ppm         RRO         0.69		Benzene	ND		0.028	0.014	0.03	8260D
Toluene         ND         0.14         0.019         7         8260D           Total Xylenes         ND         0.84         0.072         9         8260D           1,2-dibromochane (EDB)         ND         0.00010         0.000045         0.005         8011           All Other VOCs         ND         varies         varies         varies         8260D           All PAHs         ND         0.013         varies         varies         8270E-SIM           All PCBs         ND         0.012         0.0027         1         8082A           Cadmium         ND         0.92         0.089         2         6020B           Chromium <sup>2</sup> 17         1.2         0.073         19         6020B           Lead         6.9         0.58         0.22         1,600         6020B           Zinc         49         6.3         1.9         24,000         6020B           Depth = 0 to 2 feet         DRO         6.8         J         12         5.2         2,000         NWTPH-Dx           PID = 0.1 ppm         RR0         36         31         6.1         2,000         NWTPH-Dx           PID = 0.1 ppm         RR0         0.612 <td></td> <td>Ethylbenzene</td> <td>ND</td> <td></td> <td>0.14</td> <td>0.023</td> <td>6</td> <td>8260D</td>		Ethylbenzene	ND		0.14	0.023	6	8260D
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		Toluene	ND		0.14	0.019	7	8260D
1,2-dibromoethane (EDB)         ND         0.00010         0.000045         0.005         8011           All Other VOCs         ND         varies         varies         varies         8260D           All PAHs         ND         0.012         0.0027         1         8082A           Cadmium         ND         0.92         0.089         2         6020B           Cadmium         ND         0.92         0.089         2         6020B           Lead         6.9         0.58         0.055         250         6020B           Lead         6.9         0.58         0.22         1,600         6020B           Zine         49         6.3         1.9         24,000         6020B           Betropen         GRO         ND         5.8         2.1         30         NWTPH-Gx           PID = 0.1 ppm         RRO         36         31         6.1         2,000         NWTPH-Dx           PID = 0.1 ppm         Rezene         ND         0.12         0.015         7         8260D           Totate         ND         0.12         0.019         6         8260D         8260D           Totat Sylenes         ND         0.0203		Total Xylenes	ND		0.84	0.072	9	8260D
All Other VOCs         ND         varies         varies         varies         varies         strikes $8200D$ All PAHs         ND         0.013         varies         varies $8270E$ -SIM           All PCBs         ND         0.012         0.0027         1 $8082A$ Cadmium         ND         0.92         0.089         2         6020B           Chromium <sup>2</sup> 17         1.2         0.073         19         6020B           Lead         6.9         0.58         0.22         1.600         6020B           Zinc         49         6.3         1.9         24.000         6020B           B81-0511         GRO         ND         5.8         2.1         30         NWTPH-Gx           Depth = 0 to 2 feet         DRO         6.8         J         12         5.2         2,000         NWTPH-Dx           PID = 0.1 ppm         RRO         36         31         6.1         2,000         NWTPH-Dx           PID = 0.1 ppm         RRO         36         31         6.1         2,000         NWTPH-Dx           PID = 0.1 pm         RRO         0.023         0.012         0.03         8260D		1,2-dibromoethane (EDB)	ND		0.00010	0.000045	0.005	8011
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		All Other VOCs	ND		varies	varies	varies	8260D
All PCBs         ND         0.012         0.0027         1         8082A           Cadmium         ND         0.92         0.089         2         6020B           Chromium <sup>2</sup> 17         1.2         0.073         19         6020B           Lead         6.9         0.58         0.055         250         6020B           Nickel         17         0.58         0.22         1,600         6020B           Zinc         49         6.3         1.9         24,000         6020B           Depth = 0 to 2 feet         DRO         6.8         J         12         5.2         2,000         NWTPH-Dx           PID = 0.1 ppm         RRO         36         31         6.1         2,000         NWTPH-Dx           Benzene         ND         0.023         0.012         0.03         8260D           Total Xylenes         ND         0.00010         0.00004         0.005         8011           All Other VOCs         ND         varies         varies         varies         8270E-SIM           All Other VOCs         ND         0.013         0.0028         1         8082A           Cadmium         0.073         0.72         0		All PAHs	ND		0.013	varies	varies	8270E-SIM
Cadmium         ND         0.92         0.089         2         6020B           Chromium <sup>2</sup> 17         1.2         0.073         19         6020B           Lead         6.9         0.58         0.055         250         6020B           Nickel         17         0.58         0.22         1,600         6020B           Zine         49         6.3         1.9         24,000         6020B           Best         Depth = 0 to 2 feet         DRO         6.8         J         12         5.2         2,000         NWTPH-Dx           PID = 0.1 ppm         RRO         36         31         6.1         2,000         NWTPH-Dx           Benzene         ND         0.023         0.012         0.03         8260D           Toluene         ND         0.12         0.019         6         8260D           1,2-dibromoethane (EDB)         ND         0.00010         0.000044         0.005         8011           All PAHs         ND         0.012         varies         varies         8270E-SIM           All PCBs         ND         0.013         0.0028         1         8082A           Cadmium         0.073         J		All PCBs	ND		0.012	0.0027	1	8082A
Chromium <sup>2</sup> 17         1.2         0.073         19         6020B           Lead         6.9         0.58         0.055         250         6020B           Nickel         17         0.58         0.22         1,600         6020B           Zinc         49         6.3         1.9         24,000         6020B           Bept = 0 to 2 feet         DRO         6.8         J         12         5.2         2,000         NWTPH-Gx           PID = 0.1 ppm         RRO         36         31         6.1         2,000         NWTPH-Dx           Benzene         ND         0.023         0.012         0.03         8260D           Total Xylenes         ND         0.12         0.015         7         8260D           Total Xylenes         ND         0.00010         0.00044         0.005         8011           All PAHs         ND         0.013         0.0028         1         8082A           Cadmium         0.073         J         0.72         0.070         2         6020B           Lead         5.5         0.45         0.043         250         6020B           Lead         5.5         0.45         0.17 <td></td> <td>Cadmium</td> <td>ND</td> <td></td> <td>0.92</td> <td>0.089</td> <td>2</td> <td>6020B</td>		Cadmium	ND		0.92	0.089	2	6020B
Lead         6.9         0.58         0.055         250         6020B           Nickel         17         0.58         0.22         1,600         6020B           Zinc         49         6.3         1.9         24,000         6020B           SB8-1-0511         GRO         ND         5.8         2.1         30         NWTPH-Gx           Depth = 0 to 2 feet         DRO         6.8         J         12         5.2         2,000         NWTPH-Dx           Benzene         ND         0.023         0.012         0.03         8260D           Ethylbenzene         ND         0.12         0.019         6         8260D           Totuene         ND         0.12         0.019         6         8260D           Total Xylenes         ND         0.000044         0.0055         8011           All PAHs         ND         0.012         varies         varies         8260D           All PCBs         ND         0.013         0.0028         1         8082A           Cadmium         0.073         J         0.72         0.070         2         6020B           Lead         5.5         0.45         0.043         250		Chromium <sup>2</sup>	17		1.2	0.073	19	6020B
Nickel         17         0.58         0.22         1,600         6020B           Zinc         49         6.3         1.9         24,000         6020B           B88-1-0511         GRO         ND         5.8         2.1         30         NWTPH-Gx           Depth = 0 to 2 feet         DRO         6.8         J         12         5.2         2,000         NWTPH-Dx           PID = 0.1 ppm         RRO         36         31         6.1         2,000         NWTPH-Dx           Benzene         ND         0.023         0.012         0.03         8260D           Total Xylenes         ND         0.69         0.0600         9         8260D           1,2-dibromoethane (EDB)         ND         0.0010         0.00044         0.005         8011           All PAHs         ND         0.012         varies         varies         8270E-SIM           All PCBs		Lead	6.9		0.58	0.055	250	6020B
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		Nickel	17		0.58	0.22	1,600	6020B
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		Zinc	49		6.3	1.9	24,000	6020B
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	SB8-1-0511	GRO	ND		5.8	2.1	30	NWTPH-Gx
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	Depth = 0 to 2 feet	DRO	6.8	J	12	5.2	2,000	NWTPH-Dx
Benzene         ND         0.023         0.012         0.03         8260D           Ethylbenzene         ND         0.12         0.019         6         8260D           Toluene         ND         0.12         0.015         7         8260D           Total Xylenes         ND         0.69         0.060         9         8260D           1,2-dibromoethane (EDB)         ND         0.00010         0.000044         0.005         8011           All Other VOCs         ND         varies         varies         varies         8260D           All PAHs         ND         0.012         varies         varies         8260D           All PCBs         ND         0.012         varies         varies         8270E-SIM           All PCBs         ND         0.013         0.0028         1         8082A           Cadmium         0.073         J         0.72         0.070         2         6020B           Lead         5.5         0.45         0.043         250         6020B           Zine         41         5.0         1.5         24,000         6020B           Zine         41         5.0         1.5         24,000         020B	PID = 0.1  ppm	RRO	36		31	6.1	2,000	NWTPH-Dx
Ethylbenzene         ND $0.12$ $0.019$ $6$ $8260D$ Toluene         ND $0.12$ $0.015$ 7 $8260D$ Total Xylenes         ND $0.69$ $0.060$ 9 $8260D$ 1,2-dibromoethane (EDB)         ND $0.00010$ $0.000044$ $0.005$ $8011$ All Other VOCs         ND         varies         varies         varies $8270E-SIM$ All PAHs         ND $0.012$ varies         varies $8270E-SIM$ All PCBs         ND $0.013$ $0.0028$ 1 $8082A$ Cadmium $0.073$ J $0.72$ $0.070$ 2 $6020B$ Lead $5.5$ $0.45$ $0.043$ $250$ $6020B$ Lead $5.5$ $0.45$ $0.17$ $1,600$ $6020B$ Zinc         41 $5.0$ $1.5$ $24,000$ $6020B$ Zinc         41 $5.0$ $1.5$ $24,000$ $6020B$ PID = 0 ppm         RRO <td>- 11</td> <td>Benzene</td> <td>ND</td> <td></td> <td>0.023</td> <td>0.012</td> <td>0.03</td> <td>8260D</td>	- 11	Benzene	ND		0.023	0.012	0.03	8260D
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		Ethylbenzene	ND		0.12	0.019	6	8260D
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		Toluene	ND		0.12	0.015	7	8260D
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		Total Xylenes	ND		0.69	0.060	9	8260D
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		1,2-dibromoethane (EDB)	ND		0.00010	0.000044	0.005	8011
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		All Other VOCs	ND		varies	varies	varies	8260D
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		All PAHs	ND		0.012	varies	varies	8270E-SIM
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		All PCBs	ND		0.013	0.0028	1	8082A
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		Cadmium	0.073	J	0.72	0.070	2	6020B
Lead         5.5         0.45         0.003         10         10         100           Lead         5.5         0.45         0.043         250         6020B           Nickel         13         0.45         0.17         1,600         6020B           Zinc         41         5.0         1.5         24,000         6020B           SB10-1-0511         GRO         ND         6.1         2.2         30         NWTPH-Gx           Depth = 0 to 2 feet         DRO         ND         12         5.2         2,000         NWTPH-Dx           PID = 0 ppm         RRO         24         J         31         6.2         2,000         NWTPH-Dx           Benzene         ND         0.024         0.012         0.03         8260D           Ethylbenzene         ND         0.12         0.020         6         8260D           Toluene         ND         0.12         0.016         7         8260D           Total Xylenes         ND         0.73         0.063         9         8260D		Chromium <sup>2</sup>	14		0.90	0.057	19	6020B
Nickel         13         0.45         0.17         1,600         6020B           Zinc         41         5.0         1.5         24,000         6020B           SB10-1-0511         GRO         ND         6.1         2.2         30         NWTPH-Gx           Depth = 0 to 2 feet         DRO         ND         12         5.2         2,000         NWTPH-Dx           PID = 0 ppm         RRO         24         J         31         6.2         2,000         NWTPH-Dx           Benzene         ND         0.024         0.012         0.03         8260D           Ethylbenzene         ND         0.12         0.020         6         8260D           Toluene         ND         0.12         0.016         7         8260D           Total Xylenes         ND         0.73         0.063         9         8260D		Lead	5.5		0.45	0.043	250	6020B
Zinc         41         5.0         1.5         24,000         6020B           SB10-1-0511         GRO         ND         6.1         2.2         30         NWTPH-Gx           Depth = 0 to 2 feet         DRO         ND         12         5.2         2,000         NWTPH-Dx           PID = 0 ppm         RRO         24         J         31         6.2         2,000         NWTPH-Dx           Benzene         ND         0.024         0.012         0.03         8260D           Ethylbenzene         ND         0.12         0.020         6         8260D           Toluene         ND         0.12         0.016         7         8260D           Total Xylenes         ND         0.73         0.063         9         8260D		Nickel	13		0.45	0.17	1 600	6020B
SB10-1-0511         GRO         ND         6.1         2.2         30         NWTPH-Gx           Depth = 0 to 2 feet         DRO         ND         12         5.2         2,000         NWTPH-Dx           PID = 0 ppm         RRO         24         J         31         6.2         2,000         NWTPH-Dx           Benzene         ND         0.024         0.012         0.03         8260D           Ethylbenzene         ND         0.12         0.020         6         8260D           Toluene         ND         0.12         0.016         7         8260D           Total Xylenes         ND         0.73         0.063         9         8260D		Zinc	41		5.0	1.5	24,000	6020B
Depth = 0 to 2 feet         DRO         ND         12         5.2         2,000         NWTPH-Dx           PID = 0 ppm         RRO         24         J         31         6.2         2,000         NWTPH-Dx           Benzene         ND         0.024         0.012         0.03         8260D           Ethylbenzene         ND         0.12         0.020         6         8260D           Toluene         ND         0.12         0.016         7         8260D           Total Xylenes         ND         0.73         0.063         9         8260D	SR10-1-0511	GRO	ND		6.1	2.2	30	NWTPH-Gx
PID = 0 ppm         RRO         24         J         31         6.2         2,000         NWTPH-Dx           Benzene         ND         0.024         0.012         0.03         8260D           Ethylbenzene         ND         0.12         0.020         6         8260D           Toluene         ND         0.12         0.016         7         8260D           Total Xylenes         ND         0.73         0.063         9         8260D	Depth = 0 to 2 feet	DRO	ND		12	5.2	2 000	NWTPH-Dx
ND         0.024         0.012         0.03         8260D           Ethylbenzene         ND         0.12         0.020         6         8260D           Toluene         ND         0.12         0.016         7         8260D           Total Xylenes         ND         0.73         0.063         9         8260D	PID = 0  pnm	RRO	24	T	31	6.2	2,000	NWTPH-Dx
Ethylbenzene         ND         0.12         0.020         6         8260D           Toluene         ND         0.12         0.016         7         8260D           Total Xylenes         ND         0.73         0.063         9         8260D	TID 0 ppm	Benzene	ND	0	0.024	0.012	0.03	8260D
Toluene         ND         0.12         0.016         7         8260D           Total Xylenes         ND         0.73         0.063         9         8260D		Ethylbenzene	ND		0.12	0.020	6	8260D
Total Xylenes         ND         0.73         0.063         9         8260D		Toluene	ND		0.12	0.016	7	8260D
		Total Xylenes	ND		0.73	0.063	9	8260D
1.2-dibromoethane (EDB) ND 0.00010 0.000044 0.005 8011		1.2-dibromoethane (EDB)	ND		0.00010	0.000044	0.005	8011
All Other VOCs ND varies varies 8260D		All Other VOCs	ND		varies	varies	varies	8260D
All PAHs ND 0.013 varies varies 8270E-SIM		All PAHs	ND		0.013	varies	varies	8270E-SIM
All PCBs ND 0.013 0.0028 1 8082A		All PCBs	ND		0.013	0.0028	1	8082A
Cadmium 0.12 J 0.75 0.072 2 6020B		Cadmium	0.12	J	0.75	0.072	2	6020B
$Chromium^2$ 18 0.94 0.059 19 6020B		Chromium <sup>2</sup>	18		0.94	0.059	10	6020B
Lead 7.3  0.47  0.057  17  0020D		Lead	73		0.47	0.035	250	6020B
Nickel 19 0.47 0.18 1.600 6020B		Nickel	19		0.47	0.18	1 600	6020B
7  inc $48$ $51$ $15$ $24000$ $6020 B$		Zinc	48		5.1	15	24 000	6020B

Sample	Parameter	Results (mg/Kg)		RL (mg/Kg)	MDL (mg/Kg)	Ecology Cleanup Criteria <sup>1</sup> (mg/Kg)	Analytical Method
SB13-1-0511	GRO	ND		6.7	2.4	30	NWTPH-Gx
Depth = 0 to 5 feet	DRO	ND		12	5.2	2,000	NWTPH-Dx
PID = 0.2 ppm	RRO	11	J	31	6.2	2,000	NWTPH-Dx
	Benzene	ND		0.027	0.013	0.03	8260D
	Ethylbenzene	ND		0.13	0.022	6	8260D
	Toluene	ND		0.13	0.018	7	8260D
	Total Xylenes	ND		0.80	0.069	9	8260D
	1,2-dibromoethane (EDB)	ND		0.000098	0.000043	0.005	8011
	All Other VOCs	ND		varies	varies	varies	8260D
	All PAHs	ND		0.012	varies	varies	8270E-SIM
	All PCBs	ND		0.013	0.0028	1	8082A
	Cadmium	0.10	J	0.66	0.064	2	6020B
	Chromium <sup>2</sup>	15		0.83	0.052	19	6020B
	Lead	6.2		0.41	0.040	250	6020B
	Nickel	13		0.41	0.16	1,600	6020B
	Zinc	44		4.6	1.3	24,000	6020B
SB15-1-0511	GRO	ND		5.4	2.0	30	NWTPH-Gx
Depth = 0 to 2 feet	DRO	ND		12	5.1	2,000	NWTPH-Dx
PID = 0.1 ppm	RRO	9.5	J	31	6.1	2,000	NWTPH-Dx
11	Benzene	ND		0.022	0.011	0.03	8260D
	Ethylbenzene	ND		0.11	0.018	6	8260D
	Toluene	ND		0.11	0.014	7	8260D
	Total Xylenes	ND		0.65	0.056	9	8260D
	1,2-dibromoethane (EDB)	ND		0.00010	0.000044	0.005	8011
	All Other VOCs	ND		varies	varies	varies	8260D
	All PAHs	ND		0.012	varies	varies	8270E-SIM
	All PCBs	ND		0.012	0.0026	1	8082A
	Cadmium	0.093	J	0.77	0.074	2	6020B
	Chromium <sup>2</sup>	15		0.96	0.060	19	6020B
	Lead	6.4		0.48	0.046	250	6020B
	Nickel	13		0.48	0.19	1.600	6020B
	Zinc	46		5.3	1.5	24.000	6020B
SB18-1-0511	GRO	ND		5.6	2.0	30	NWTPH-Gx
Depth = 5 to 10 feet	DRO	ND		9.9	4.2	2.000	NWTPH-Dx
PID = 0 ppm	RRO	ND		25	5.0	2.000	NWTPH-Dx
•	Benzene	ND		0.023	0.011	0.03	8260D
	Ethylbenzene	ND		0.11	0.018	6	8260D
	Toluene	ND		0.11	0.015	7	8260D
	Total Xylenes	ND		0.68	0.058	9	8260D
	1,2-dibromoethane (EDB)	ND		0.000080	0.000035	0.005	8011
	All Other VOCs	ND		varies	varies	varies	8260D
	All PAHs	ND		0.010	varies	varies	8270E-SIM
	All PCBs	ND		0.010	0.0022	1	8082A
	Cadmium	ND		0.63	0.060	2	6020B
	Chromium <sup>2</sup>	6.7		0.78	0.049	19	6020B
	Lead	17		0.39	0.038	250	6020B
	Nickel	4.8		0.39	0.15	1,600	6020B
	Zinc	15		4.3	1.3	24,000	6020B

Sample	Parameter	Results (mg/Kg)		RL (mg/Kg)	MDL (mg/Kg)	Ecology Cleanup Criteria <sup>1</sup> (mg/Kg)	Analytical Method
SB20-1-0511	GRO	ND		5.8	2.1	30	NWTPH-Gx
Depth = 5 to 10 feet	DRO	ND		10	4.3	2,000	NWTPH-Dx
PID = 0 ppm	RRO	ND		25	5.1	2,000	NWTPH-Dx
	Benzene	ND		0.023	0.012	0.03	8260D
	Ethylbenzene	ND		0.12	0.019	6	8260D
	Toluene	ND		0.12	0.016	7	8260D
	Total Xylenes	ND		0.70	0.060	9	8260D
	1,2-dibromoethane (EDB)	ND		0.000084	0.000037	0.005	8011
	All Other VOCs	ND		varies	varies	varies	8260D
	All PAHs	ND		0.010	varies	varies	8270E-SIM
	All PCBs	ND		0.011	0.0023	1	8082A
	Cadmium	0.079	J	0.61	0.059	2	6020B
	Chromium <sup>2</sup>	14		0.76	0.048	19	6020B
	Lead	6.8		0.38	0.037	250	6020B
	Nickel	13		0.38	0.15	1,600	6020B
	Zinc	45		4.2	1.2	24,000	6020B
SB20-2-0511	GRO	ND		6.4	2.3	30	NWTPH-Gx
Duplicate of SB20-1-0511	DRO	ND		11	4.4	2,000	NWTPH-Dx
	RRO	ND		26	5.3	2,000	NWTPH-Dx
	Benzene	ND		0.026	0.013	0.03	8260D
	Ethylbenzene	ND		0.13	0.021	6	8260D
	Naphthalene	0.042	J	0.26	0.036	5	8260D
	Toluene	ND		0.13	0.017	7	8260D
	Total Xylenes	ND		0.77	0.066	9	8260D
	1,2-dibromoethane (EDB)	ND		0.000081	0.000035	0.005	8011
	All Other VOCs	ND		varies	varies	varies	8260D
	All PAHs	ND		0.010	varies	varies	8270E-SIM
	All PCBs	ND		0.011	0.0023	1	8082A
RPD = 23 %	Cadmium	0.10	J	0.72	0.070	2	6020B
RPD = 7 %	Chromium <sup>2</sup>	15		0.90	0.057	19	6020B
RPD = 3 %	Lead	7.0		0.45	0.043	250	6020B
RPD = 7 %	Nickel	14		0.45	0.17	1,600	6020B
RPD = 6 %	Zinc	48		5.0	1.5	24,000	6020B

<sup>1</sup> Soil cleanup criteria are obtained from WAC 173-340-900 (October 25, 2019), Method A values for unrestricted land use; except for nickel and zinc, which are obtained from Method B noncancer values.

<sup>2</sup> The samples were analyzed for total chromium, including chromium-3 and chromium-6; and the reported concentrations are compared to the cleanup criterion for chromium-6, which has a more conservative cleanup criterion than chromium-3.

Ecology = Washington State Department of Ecology; WAC = Washington Administrative Code; mg/Kg = milligrams per kilogram; RL = reporting limit; MDL = minimum detection limit; ND = not detected; J = estimated concentration; RPD = relative percent difference

Sample	Parameter	Results (µg/L)		RL (µg/L)	MDL (µg/L)	Ecology Cleanup Criteria <sup>1</sup> (μg/L)	Analytical Method
MW1-0511	GRO	ND		150	70	1,000	NWTPH-Gx
	DRO	ND		230	110	500	NWTPH-Dx
	RRO	ND		380	110	500	NWTPH-Dx
	Benzene	ND		0.20	0.03	5	8260D
	1,2-dibromo-3-chloropropane	<u>ND</u>		<u>2.0</u>	<u>0.44</u>	0.200	8260D
	1,2-dichlorobenzene	0.047	J	0.30	0.04	600	8260D
	Ethylbenzene	ND		0.20	0.03	700	8260D
	Toluene	ND		0.20	0.05	1,000	8260D
	1,2,3-trichloropropane	ND		0.20	<u>0.050</u>	0.000384	8260D
	Total Xylenes	ND		1.00	0.27	1,000	8260D
	1,2-dibromoethane (EDB)	ND		0.000010	0.0000025	0.01	8011
	All Other VOCs	ND		varies	varies	varies	8260D
	All PAHs	ND		0.087	varies	varies	8270E-SIM
	All PCBs	ND		0.098	varies	0.1	8082A
	Cadmium	1.1	J	2.00	0.19	5	6020B
	Chromium	110		4.00	0.87	50	6020B
	Lead	52		2.00	0.20	15	6020B
	Nickel	140		15.00	0.63	100	6020B
	Zinc	340		35.00	4.60	4,800	6020B
MW2-0511	GRO	ND		150	70	1,000	NWTPH-Gx
duplicate of MW1-0511	DRO	ND		240	110	500	NWTPH-Dx
	RRO	ND		390	120	500	NWTPH-Dx
	Benzene	ND		0.20	0.030	5	8260D
	<u>1,2-dibromo-3-chloropropane</u>	<u>ND</u>		<u>2.0</u>	<u>0.44</u>	0.200	8260D
	Ethylbenzene	ND		0.20	0.030	700	8260D
	Toluene	ND		0.20	0.050	1,000	8260D
	<u>1,2,3-trichloropropane</u>	<u>ND</u>		<u>0.20</u>	0.050	0.000384	8260D
	l otal Xylenes	ND		1.00	0.27	1,000	8260D
	All Othern VOCa	ND		0.000010	0.0000023	0.01	8260D
	Fluoranthene	0.016	T	0.087	0.016	640	8200D 8270E SIM
	Fluorene	0.010	J	0.087	0.010	640	8270E-SIM
	Naphthalene	0.020	J	0.087	0.015	160	8270E-SIM
	All Other PAHs	0.000 ND	3	0.087	varies	varies	8270E-SIM
	All PCBs	ND		0.007	varies	0.1	8082A
RPD = 24 %	Cadmium	1.4	J	2.0	0.19	5	6020B
RPD = 31%	Chromium	150	-	4.0	0.87	50	6020B
RPD = 27 %	Lead	68		2.0	0.20	15	6020B
RPD = 25%	Nickel	180		15	0.63	100	6020B
RPD = 30%	Zinc	460		35	4.6	4.800	6020B
MW3-0511	GRO	ND		150	70	1.000	NWTPH-Gx
	DRO	230	J	250	110	500	NWTPH-Dx
	RRO	400	J	410	120	500	NWTPH-Dx
	Benzene	ND		0.20	0.030	5	8260D
	1,2-dibromo-3-chloropropane	<u>ND</u>		<u>2.0</u>	<u>0.44</u>	0.200	8260D
	Ethylbenzene	ND		0.20	0.030	700	8260D
	Toluene	0.060	J	0.20	0.050	1,000	8260D
	1,2,3-trichloropropane	<u>ND</u>		<u>0.20</u>	<u>0.050</u>	0.000384	8260D
	Total Xylenes	ND		1.00	0.27	1,000	8260D
	1,2-dibromoethane (EDB)	ND		0.000010	0.0000025	0.01	8011
	All Other VOCs	ND		varies	varies	varies	8260D
	Fluorene	0.017	J	0.096	0.017	640	8270E-SIM
	All Other PAHs	ND		0.096	varies	varies	8270E-SIM
	All PCBs	ND		0.11	varies	0.1	8082A
	Cadmium	ND	_	2.0	0.19	5	6020B
	Chromium	1.4	J	4.0	0.87	50	6020B
	Lead	ND		2.0	0.20	15	6020B
	Nickel	2.6	J	15	0.63	100	6020B
	Linc	11	J	35	4.6	4,800	6020B

Sample	Parameter	Results (µg/L)		RL (µg/L)	MDL (µg/L)	Ecology Cleanup Criteria <sup>1</sup> (μg/L)	Analytical Method
MW4-0511	GRO	ND		150	70	1,000	NWTPH-Gx
	DRO	310		260	120	500	NWTPH-Dx
	RRO	310	J	430	130	500	NWTPH-Dx
	Benzene	ND		2.0	0.30	5	8260D
	1,2-dibromo-3-chloropropane	<u>ND</u>		<u>20</u>	<u>4.4</u>	0.200	8260D
	Ethylbenzene	ND		2.0	0.30	700	8260D
	<u>Hexachlorobutadiene</u>	<u>ND</u>		<u>5.0</u>	<u>0.67</u>	0.561	8260D
	<u>Methylene Chloride</u>	<u>ND</u>		<u>50</u>	<u>12</u>	5.00	8260D
	1,1,1,2-Tetrachloroethane	ND		3.0	0.38	1.68	8260D
	1,1,2,2-Tetrachloroethane	<u>ND</u>		<u>2.0</u>	<u>0.56</u>	0.219	8260D
	Toluene	ND		2.0	0.50	1,000	8260D
	<u>1,2,3-trichloropropane</u>	<u>ND</u>		<u>2.0</u>	<u>0.50</u>	0.000384	8260D
	Total Xylenes	ND		10.0	2.7	1,000	8260D
	1,2-dibromoethane (EDB)	ND		0.000010	0.0000025	0.01	8011
	All Other VOCs	ND		varies	varies	varies	8260D
	1-methylnaphthalene	0.035	J	0.097	0.025	1.51	8270E-SIM
	2-methylnaphthalene	0.064	J	0.097	0.047	32.0	8270E-SIM
	Acenaphthylene	0.024	J	0.097	0.017	N/A	8270E-SIM
	Fluoranthene	0.021	J	0.097	0.018	640	8270E-SIM
	Fluorene	0.025	J	0.097	0.017	640	8270E-SIM
	Naphthalene	0.076	J	0.097	0.057	160	8270E-SIM
	All Other PAHs	ND		0.097	varies	varies	8270E-SIM
	All PCBs	ND		0.10	varies	0.1	8082A
	Cadmium	ND		2.0	0.19	5	6020B
	Chromium	6.0		4.0	0.87	50	6020B
	Lead	1.3	J	2.0	0.20	15	6020B
	Nickel	20		15	0.63	100	6020B
	Zinc	16	J	35	4.6	4,800	6020B

<sup>1</sup> Groundwater cleanup criteria are obtained from WAC 173-340-900 (October 25, 2019), CLARC values.

WAC = Washington Administrative Code; N/A = not available; RPD = relative percent difference; J = estimated concentration

 $\mu g/L =$  micrograms per liter; GRO = gasoline range organics; DRO = diesel range organics; RRO = residual range organics; MDL = method detection

limit; RL = reporting limit; ND = not detected; PAHs = Polynuclear Aromatic Hydrocarbons; PCBs = polychlorinated biphenyls

VOCs = volatile organic compounds; CLARC = Cleanup Levels and Risk Calculation

*Italics* = the RL exceeds the applicable cleanup criterion.

<u>Underline</u> = the MDL exceeds the applicable cleanup criterion.

**BOLD** = the result exceeds the applicable cleanup criterion.

BGES, INC.

#### **APPENDIX A**

#### DRAYTON ARCHAEOLOGY CULTURAL RESOURCES REPORT

### CULTURAL RESOURCES REPORT COVER SHEET

DAHP Project Number: 2021-05-02714

Author: <u>G</u>	arth L. Baldwin and Choya Davis
Title of Report: <u>C</u> City Purchase, Othello	ultural Resource Review of Parcel 2529040120001, for a Potential
Date of Report: <u>M</u>	<u>lay 11, 2021</u>
County(ies): <u>Adams</u>	Section: <u>4</u> Township: <u>15N</u> Range: <u>29E</u>
	Quad: <u>Othello</u> Acres: <u>70.55</u>
PDF of report submitte	ed (REQUIRED)
Historic Property Inve	ntory Forms to be Approved Online? 🗌 Yes 🛛 No
Archaeological Site(s)	/Isolate(s) Found or Amended?  Yes No
TCP(s) found?  Yes	<u>3 🕅 No</u>
Replace a draft?  Y	es 🖂 No
Satisfy a DAHP Archa	eological Excavation Permit requirement? 🗌 Yes # 🔀 No
Were Human Remain	s Found? 🗌 Yes DAHP Case # 🛛 🛛 No
DAHP Archaeological	Site #: • Submission of PDFs is required.
	<ul> <li>Please be sure that any PDF submitted to DAHP has its cover sheet, figures graphics, appendices, attachments</li> </ul>

correspondence, etc., compiled into one

single PDF file.



Cultural Resource Review of Parcel 2529040120001, for a Potential City Purchase, Othello, Washington



Prepared By: Garth L. Baldwin, M.A., RPA 16248 and Choya Davis, M.A.

Prepared For: Rose Pollock Senior Environmental Scientist BGES, Inc. Seattle Washington 98166

**Drayton Archaeological Report: 0421A** 

May 11, 2021
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# Cultural Resource Review of Parcel 2529040120001, for a Potential City Purchase, Othello, Washington

Author:	Garth L. Baldwin and Choya Davis
Date:	May 11, 2021
Location:	Othello, Adams County, Washington
USGS Quad:	Othello, WA (1979)
Section, Township, Range	Section 4, Township 15 North, Range 29 East, Willamette Meridian

# Summary

Drayton Archaeology (Drayton) was retained by Rose Pollock of BGES, Inc. to conduct a cultural resources assessment for the proposed acquisition property, Parcel 2529040120001, an approximate 70.55-acre site in the City of Othello, Adams County, Washington. We presume that any regulatory compliance for development and construction on the property would likely involve the US Army Corps of Engineers due to the presence of areas of wetland.

Drayton's cultural resources assessment for this project consisted of background review, field investigation, and production of this report. Background review determined that the APE is located in an area of low probability for cultural resources. Field investigation consisted of pedestrian survey and subsurface investigation. No precontact or historic cultural resources were encountered. Based on the results of the review and the low probability for significant cultural deposits in the APE, Drayton recommends that the project proceed without further archaeological oversight.

# **Regulatory Context**

This present cultural resource review project was conducted, in part, to satisfy regulatory requirements for Section 106 of the NHPA, as amended, and the implementing regulations in 36 CFR Part 800. Section 106 requires Federal agencies take into account the effects of their undertakings on historic properties. A historic property is typically aged 50 years or older and is defined in 36 CFR part 800.16(1)(1), as follows:

... any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the NRHP maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria.

The procedures under Section 106 generally require the Federal agency involved in the undertaking to identify the Area of Potential Effects (APE), inventory any historic properties that

may be located within the APE, and determine if the identified historic properties located within the APE may be eligible to be listed in or eligible for listing in the NRHP. An APE is defined in 36 CFR 800.16(d), as follows:

... the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking.

If NRHP-eligible historic properties are identified within the APE then potential adverse effects to the historic properties must be assessed and a resolution of adverse effects recommended. Under Section 106, the responsible Federal agency must, at minimum, consult with and seek comment from the State Historic Preservation Officer (SHPO) and/or the Tribal Historic Preservation Officer (THPO), as applicable, and consult with any affected or potentially affected Native American Tribe(s).

# **Project Location and Description**

The project is located in Othello, Adams County, Washington (Figures 1 - 2). The APE is an approximate 70.55-acre parcel (TPN: 2529040120001) along West Cunningham Road. The legal description is Section 4 of Township 15 North, Range 29 East, Willamette Meridian. The project is currently in the planning stages.



Figure 1. Portion of the USGS (1979) Othello, WA 7.5' quadrangle map identifying the APE.



Figure 2. Aerial detailing the location of the project.

# **Background Review**

Determining the probability for cultural resources to be present within the APE was based upon review and analysis of the environmental and cultural context of the area and cultural resource studies and sites previously recorded within close proximity. Consulted sources included local geologic data to better understand the depositional context; archaeological, historic and ethnographic records on file on the Washington Information System for Architectural and Archaeological Records Data (WISAARD) database; and selected published local historic records.

# Environmental Context

The project is located in the Columbia River Plateau (also known as the Columbian Basin) physiographic province that extends between the Cascade Range of Washington and Oregon and the Rocky Mountains at Idaho (Franklin and Dyrness 1973; Ray 1936:102). The Columbia River Plateau is a broad basin that formed during the Miocene as flood basalts erupted from long fissures and spread out over the land (Baker et al. 1991; Hooper 1982). Hooper (1982) estimates that more than 200,000 km3 of lava flowed over the Columbia Basin between 17 and 6 million years ago. As the basalt flowed out and covered the land, the earth's crust gradually sank and a large basin was formed. In some areas, the basalt is overlain with alluvial gravels deposited during the Pliocene, glacial outwash and wind-blown loess deposited during the Pleistocene, and/or Holocene alluvium (Baker et al. 1991, Lasmanis 1991).

During the late Pleistocene, the Columbia River Plateau experienced regular cataclysmic floods following the backup of water behind ice-dammed glacial Lake Missoula (Bretz 1969). Additional flooding occurred after 11,500 years ago leaving unweathered gravel and erratics across the uplands. Sand and gravel deposits are capped by Aeolian mantle composed of heavy bioturbated sand and volcanic ash.

# Soils

According to the United States Department of Agriculture – Natural Resources Conservation Service ([USDA-NRCS] n.d.), soils in the APE are composed primarily of Esquatzel silt loam, 0 to 2 percent slopes and Scooteney stony loam, 0 to 15 percent slopes.

Commonly found on valleys and flood plains, the Esquatzel series consists of a very deep, well drained silty alluvium with slopes of 0 to 5 percent. A typical pedon consists of an Ap1 horizon 0 to 5 cm; silt loam, an Ap2 horizon5 to 18 cm; silt loam, boundary, an AB horizon 18 to 74 cm; silt loam, a Bk1 horizon 74 to 112 cm; silt loam, and a Bk2 horizon 112 to 175 cm; silt loam (UC Davis SoilWeb n.d.).

The Scooteney series consists of very deep, well drained soils formed in alluvium. Scooteney soils are on alluvial fans and terraces with slopes of 0 to 30 percent. A typical pedon consists of an A horizon 0 to 4 inches (0 - 10 centimeters); brown loam, a Bw horizon 4 to 18 inches (10 - 45.7 centimeters); brown very fine sandy loam, a Bk1 horizon 18 to 29 inches (45.7 - 73 centimeters);

light brownish gray gravelly very fine sandy loam, and a Bk2 horizon 29 to 60 inches (73 - 152 centimeters); light brownish gray very cobbly and sandy loam (UC Davis SoilWeb n.d.).

# Climate

The climate in and around the APE is semiarid and native vegetation is mostly limited to shrubs and grasses. Primary drainages include the Columbia and Snake rivers. Regional pollen profiles suggest the post-glacial climate was cooler and moister than today (Barnosky et al 1987). Contemporary temperatures were established within the last 4000 years and are characterized by hot summers and cool winters.

# Cultural Context

According to archaeological evidence, humans have been in the Columbia Basin for the last 11,000 years. The impetus for the majority of the archaeological studies in the area is a result of the construction of hydroelectric dams along the Columbia River. Basic cultural chronologies for the region have been developed and include several phases such as Paleo Indian, Windust, Vantage, Frenchman Springs, and Quilomene Bar and Cayuse (Swanson 1962). The phases generally represent subsistence economies changing over time from a focus on anadromous fish runs to reliance on terrestrial mammals. By 5,000 before present (BP) semi-subterranean pit houses and large-scale food storage are present indicating an increase sedentary occupation.

The project is located in the traditional territory of the Middle Columbia River Salish (Miller 1998:254; Ray 1936:103). The Middle Columbia River Salish consisted of several groups that settled primarily along the Columbia River and its western or northern tributaries (Miller 1998:253). Miller (1998:253) and Ray (1936:103) have assigned the APE specifically to the Sinkiuse (or Columbias). Permanent Middle Columbia Salish groups were commonly established on waterways (Ray 1936:117). Villages often consisted of semi-subterranean structures and mat lodges. Summers were spent in temporary lodges in open prairies of highlands. Several ethnographic Middle Columbia River Salish villages have been recorded by Ray (1936:119) and Miller (1998:254); none were located in the APE. The nearest reviewed previously recorded ethnographic sites to the APE were located north near Moses Lake.

The Middle Columbia Salish, generally practiced a subsistence strategy based on seasonal availability of natural resources. During the spring and summer these groups gathered plant resources, fished, hunted and prepared foods for winter storage. Winter activities were spent making and repairing tools, partaking in religious ceremonies, and preparing for the return of spring.

In 1805, Lewis and Clark traveled through the greater area while on an expedition to explore and map the newly acquired territory. By 1809 trappers and fur traders were frequent in the local area. In 1818 Fort Walla Walla was constructed by the Hudson's Bay Company. By 1925, the Hudson Bay Company built Fort Colville at Kettle Falls to serve as a base station for boundary

commissioners surveying the United States and Canadian borders. In the 1940s, the trading industry collapsed and missionaries soon relocated to the area with the intentions of assimilating the local tribal groups. As non-native settlements began to encroach on Native Americans, tensions increased and treaties were soon established which forced the local tribes to reservation. The Sinkiuse as well as other Middle Columbia tribal groups were initially assigned to the Columbia (or Moses) Reservation, however the reservation was relinquished almost immediately, and the Sinkiuse were subsequently relocated to the Colville Reservation (Ruby and Brown 1986:204-205).

Non-native settlement of Othello is attributed to Ben and Sam Hutchinson, two brothers who built a cabin along Crab Creek in 1884. The post office was established in 1904. In 1907, the Chicago, Milwaukee & St Paul was extended through Adams County. Early development initiated around the railroad and included a depot and hotel. Othello was incorporated in 1910 (Hitchman 1985:220). In the 1950s the Columbia Basin Project brought irrigation to the area which promoted the local agricultural industry. Following the installation of irrigation, land was made available for purchase via drawing. In 1958, an ice plant was opened that serviced railroad cars shipping produce. Frozen food packaging is the main industry of Othello today.

# Previous Archaeology and Cultural Resources Studies

According to the Washington State Department of Archaeology and Historic Preservation's (DAHP) Washington Information System for Architectural and Archaeological Records Data (WISAARD) database, six cultural resource studies have been conducted within an approximate 1.6-kilometer (1 mile) radius of the APE (Table 1). Surveys in the project's vicinity were typically conducted to satisfy regulatory compliance for development related to municipal infrastructure/utilities.

The nearest survey was conducted to the immediate northwest of the current project for proposed municipal water service upgrades, and did not result in the identification of any precontact or historic cultural materials (Harder 2018). In 2019, Drayton completed a cultural resource survey for the City of Othello's Parks and Recreation Department at Lions Park, located 1.3 km (0.8 mi) northeast of the current project (Baldwin et al. 2019). No cultural materials were identified during the course of the investigation.

Reference	Report Title	Results
Baldwin, et al. 2019	Cultural Resources Assessment at Lions Park, Othello, Adams County, Washington	Negative
Clennon 2019	Addendum to the Cultural Resources Overview for the Alpha WWTP Project, Othello, Adams County, Washington	45AD255; Historic debris scatter

Table 1. Cultural resources surveys recorded on WISAARD within a 1.6 km radius.

Reference	Report Title	Results
Kleinschmidt and Clennon 2019	Cultural Resources Overview for the Alpha WWTP Project, Othello, Adams County, Washington	45AD255; Historic debris scatter
Harder 2018	Cultural Resource Survey for the City of Othello Water Supply & Storage Project, Adams County, Washington	Negative
Iversen et al. 2012	Cultural Resources Survey for the 2012/2013 Construction Season of the East Columbia Basin Irrigation District Water SMART Grant Project	Irrigation structures
McKenney 2006	A Cultural Resources Survey of the Washington State Department of Transportation's Pit Site PS-AD-88	Negative

WISAARD lists one archaeological site within the same search radius. Site 45AD255 is described as a historic debris scatter/concentration and consists of early-1900s amethyst, aqua, amber, and clear glass fragments, ceramic fragments, and a single bivalve shell fragment (Clennon 2019). The scatter is located approximately 1 mile north of the northern boundary of the current APE.

# **Cultural Resource Expectations**

Based on our background review the project is considered to be located in an area of low probability for cultural resources. Precontact archaeology is unlikely to be present as there is no fresh water access in the parcel; and, no ethnographic or archaeological sites have been previously recorded in or near the project. Historic cultural resources are relatively more likely to be encountered in the APE and might be representative of past agricultural or recreational activities. Considering the depositional environment of the APE, any potential cultural resources in the APE would be expected to be in shallow deposits.

# **Field Investigation**

The physical archaeological assessment of an area is conducted through visual reconnaissance of the APE, examination of existing ground disturbances and subsurface excavation as needed. Surface survey of an area proposed for ground alteration or other impact is employed in an attempt to locate any surficial cultural materials or structures with any historic or archaeological importance or cultural concern. When utilized, shovel probes (SP or SPs) or mechanical excavation can assist in providing a wider sample of subsurface soil conditions for determining the potential for, or presence/absence of, buried archaeological deposits. The employment of probes or trenches is most often dependent upon considerations of the landform, topography, project proposal and subsurface geologic conditions.

On April 20 and 21, a survey of Parcel 2529040120001 was conducted by Drayton archaeologist Choya Davis. The survey consisted of two components: a pedestrian survey and shovel testing of

selected locations. Pedestrian survey was conducted by walking the entire perimeter of the parcel and walking transect lines spaced 30 meters apart (Photos 1 - 2). Transect lines were predominantly north-south, with a small portion of the parcel surveyed with east-west transects (Photos 3 - 4). Navigation was monitored with a Garmin Dakota 20 GPS unit set to the WGS 84 datum. The northwest quadrant of the parcel was a marsh that proved inaccessible to both pedestrian survey and shovel probes (Photo 5).



Photo 1. South to southwest overview of the parcel.



Photo 2. Southeastern overview of the northwestern corner of the parcel.



Photo 3. North to northeast overview of the parcel.



Photo 4. Staked out areas within the parcel. View is south.



Photo 5. Western overview of the marsh area.

Four shovel probes were placed in selected locations (Figure 3). Locations were determined according to both accessibility and the probability of subsurface cultural deposits. Shovel probes measured approximately 35 cm in diameter and were dug to depths from 50 - 108 cm below the ground surface. Excavated sediments were sifted through ¼-inch wire mesh and inspected for cultural materials. A detailed description of the shovel probe can be found in Appendix A.

Sediment profiles were generally consistent across the corridor and resembled the Esquatzel and Scooteney soil series described previously. Typical profiles consisted of one stratum, with light brown silty loams with minimal pebbles and gravel (Photo 6).

While no precontact or immediately temporally diagnostic historic cultural materials were identified, the parcel displayed modern trash suggesting a variety of modern activities, including recreation, trash dumping, and agriculture (Photos 7 - 10). Beverage bottles and cans, food packaging, toys, tires, scrap metal, electrical equipment components, and one recently placed firepit were observed. Other identified materials and features appear related to agriculture and/or irrigation and plumbing included scraps of fencing, fragments of PVC pipe, metal pipes, a destroyed concrete structure adjacent to a sewer manhole cover, and the remnants of a bridge or platform built over the marsh.



Figure 3. An adapted Google Earth aerial image illustrating the location of the shovel probes excavated across the APE.



Photo 6. Soil profile typically observed in shovel probes (SP1).



Photo 7. Modern garbage observed during survey.



Photo 8. Owens Illinois glass bottle.



Photo 9. Concrete rubble adjacent to maintained dirt road. View is south.



Photo 10. Remnants of a wooden structure at the southern end of the marsh area.

#### **Conclusions and Recommendations**

Drayton's cultural resources assessment for this project included background review, field investigation, and production of this report. Background review determined that the project is located in an area of low probability for cultural resources. Field investigation consisted of pedestrian survey and subsurface investigation. No precontact and/ or immediately temporally diagnostic historic resources were encountered. Based on the results of the present review, and the assertion that there is a low probability for encountering significant cultural deposits in the APE, Drayton recommends that the project proceed without further archaeological oversight.

It should also be recognized that Washington State law provides for the protection of archaeological resources in the state. Washington State Revised Codes of Washington (RCW) Chapter 27.53, Archaeological Sites and Resources, prohibits the unauthorized removal, theft, and/or destruction of archaeological resources and sites. This statute also provides for prosecution and financial penalties covering consultation and the recovery of archaeological resources. Additional legal oversight is provided for Indian burials and grave offerings under RCW Chapter 27.44, Indian Graves and Records. RCW 27.44 states that the willful removal, mutilation, defacing, and/or destruction of Indian burials constitute a Class C felony. A recent addition to Washington legal code, RCW 68.50.645, Notification, provides a strict process for the notification of law enforcement and other interested parties in the event of the discovery of any human remains regardless of perceived patrimony. The assessment of the property has been conducted by a

professional archaeologist and meets or exceeds the criteria set forth in RCW: 27.53 for professional archaeological reporting and assessment.

The following section, Inadvertent Discovery Protocols (IDP), has been included in this document to assist property owners, project managers, construction crews, and others responsible for work, in the necessary and appropriate steps to follow in the event that archaeological materials are encountered during the project. This is recommended, regulators reserve the right to employ any IDP they may choose.

# **Inadvertent Discovery Protocols**

# Archaeological Resources:

In the event that archaeological materials (e.g., shell midden, faunal remains (bones), stone tools, historic glass, metal, or other concentrations) are encountered during the development of the property, an archaeologist should immediately be notified and work halted in the vicinity of the find until the materials can be inspected and assessed. The project archaeologist should be contacted immediately to review the find and contact the relevant parties. An assessment of the discovery and consultation with government and tribal cultural resources staff is a requirement of law. Once the situation has been assessed steps to proceed can be determined.

# Human Burials, Remains, or Unidentified Bone(s)

In the event of inadvertently discovered human remains or indeterminate bones, pursuant to RCW 68.50.645, all work must stop immediately and law enforcement should be contacted. Any remains should be covered and secured against further disturbance, and communication should be immediately established with the Othello Police Department and the State Physical Anthropologist at DAHP for coordination with interested Native Tribe(s).

The area surrounding the discovery should be secured and of adequate size to protect the discovery from further disturbance until the State provides a notice to proceed. The discovery of any human skeletal remains must be reported to law enforcement immediately. The county medical examiner/coroner will assume jurisdiction over the human skeletal remains to decide whether those remains are forensic or non-forensic. If the county medical examiner/coroner determines the remains are non-forensic, then the State Physical Anthropologist at DAHP assumes the jurisdiction over the remains. The DAHP will notify any appropriate cemeteries and all affected tribes of the find. The State Physical Anthropologist will determine whether the remains are Native or Non-Native origin and report that finding to any appropriate cemeteries and the affected tribes. The DAHP will then handle all consultation with the affected parties as to the future preservation, excavation, and disposition of the remains. DAHP will also authorize when work may proceed.

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#### University of California Davis SoilWeb Map (UC Davis SoilWeb)

n.d. UC Davis California Soil Resource Lab's SoilWeb Interactive map, displaying Natural Resource Conservation Service (NRCS) soils data. Electronic resource, <u>http://casoilresource.lawr.ucdavis.edu/gmap/</u>, accessed May 2021.

# **Appendix A: Shovel Probe Index**

DEPTH BELOW SURFACE (CM)	SEDIMENT DESCRIPTION	RESULTS
	SP1	
0-50	Light brown loamy silt with minimal pebble and gravel content.	Negative
UTM's	333455 E, 5187687 N	
Notes	Impassable rocks at 50 cm.	
SP2		
0-56	Light brown loamy silt with minimal pebble and gravel content.	Negative
UTM's	333514 E, 5187378 N	
Notes	Impassable rocks at 56 cm.	
	SP3	
0-65	Extremely compact light-brown loamy silt. Minimal pebbles and gravels.	Negative
UTMs	333268 E, 5187423 N	
Notes	Impassable rock at 65 cm.	
SP4		
0-108	Moist brown silty loam. Becomes increasingly saturated with depth.	Negative
UTM's	333288 E, 5187648 N	
Notes	Began to fill with water immediately after reaching 108 cm.	

BGES, INC.

# APPENDIX B BGES WORK PLAN FOR SOIL AND GROUNDWATER ASSESSMENT DATED APRIL 19, 2021

Providing Environmental & Geological Consulting Services



126 SW 148<sup>th</sup> St, Suite C100-267 Seattle, Washington 98166 (206) 569-4554

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ENVIRONMENTAL CONSULTANTS

April 19, 2021

Shawn Logan, Mayor City of Othello, Washington 500 Main Street Othello, WA 99344

# RE: WORK PLAN FOR SOIL AND GROUNDWATER ASSESSMENT; PARCEL 2529040120001 (TRUMAN PROPERTY), OTHELLO, WASHINGTON

Dear Mr. Logan:

BGES, Inc. (BGES) is pleased to present our work plan for conducting soil and groundwater assessment activities and a Phase I environmental site assessment (ESA) update at the above-referenced location; hereafter referred to as the subject property. The purpose of these activities is to determine the approximate extent of soil and groundwater contamination.

#### BACKGROUND

BGES conducted a Phase I ESA of the subject property in October of 2020 and identified a recognized environmental condition stemming from staining and free product on the central portion of the property, and the potential for contamination to exist in surface and subsurface soils at quantities and concentrations that would be deemed actionable by the Washington Department of Ecology (DOE). With this in mind, we have developed the following scope of work to evaluate the presence of contamination on the subject property.

#### **SCOPE OF WORK**

The following activities will be conducted in general accordance with DOE regulations and guidance documents, and the Site-Specific Health and Safety Plan included in Attachment 1. Any deviations from this work plan will be discussed in the final report. All field work will be performed by an experienced Environmental Scientist overseen by a Geologist who is registered in the State of Washington. All field activities will be documented in the project-specific field notebook.

#### Task 1 – Cultural Resource Records and Pedestrian Survey

For this task, BGES will subcontract Drayton Archaeology (Drayton) to perform an archaeological review of the subject property. This review will include a search of cultural resource records and an onsite pedestrian survey. Drayton will issue a report of their findings, and BGES will append that report to our final report, as discussed in Task 4; below.

# Task 2 – Soil and Groundwater Investigation

Prior to mobilizing to the subject property, and after receiving a Joint Aquatic Resources Permit from the United States Army Corps of Engineers (USACE), BGES will coordinate with the Utilities Underground Location Center to request the marking of all underground utilities in the vicinity of the project activities. If marking the investigation area with white spray paint is requested by the Utilities Underground Location Center, we have assumed that a representative from the City of Othello will be available to accomplish this (BGES will provide a map showing the area to be marked).

Our drilling subcontractor, Environmental Services Network (ESN), will mobilize to Othello. The subject property will be evaluated for stained areas, tanks, drums, stressed vegetation, and any other areas of potential environmental concern observed during the Phase I ESA site reconnaissance, which will be accomplished by BGES prior to ESN's arrival. Preliminary locations for soil boring placement, and selection of soil borings for monitoring wells, are depicted on Figures 1 and 2. Final locations may be adjusted in the field depending upon actual hydrogeologic observations or obvious evidence of contamination.

Up to 20 shallow soil borings, as depicted on Figures 1 and 2, will be advanced in the general vicinity of the staining and free product identified during the Phase I ESA, and on the eastern portion of the property; using a Geoprobe drilling rig and Macro-core sampling methods. Up to 10 soil samples (one sample from approximately half of the borings) will be collected and submitted to Eurofins TestAmerica Laboratories (TestAmerica) in Seattle; a DOE-approved laboratory, for the analyses listed below in Task 3, to evaluate the current environmental condition of the subject property. If additional areas of concern are identified, we will discuss with you our recommended course of action for collection of additional soil samples.

BGES will use clean, stainless-steel spoons to collect samples directly into laboratory-supplied containers. The sample portions scheduled to be analyzed for volatile compounds will be collected first and will be preserved with laboratory-supplied methanol immediately upon collection. The methanol will be added to the samples in a manner that completely covers the sample portions. The sample containers will be

labeled and placed in a cooler with gel ice.

An additional portion of each sample will be placed into a sealable plastic bag that will be labeled with a unique sample number and the time of collection. The soil in each bag will be screened with a photoionization detector (PID) that will be calibrated prior to use with 100 parts per million (ppm) isobutylene calibration gas. The soil in the bag will be agitated for approximately 15 seconds, then warmed for at least 10 minutes to a temperature of at least 40 degrees Fahrenheit. Then, within 1 hour of collection, the plastic bags will be agitated again for approximately 15 seconds and the probe of the PID will be inserted into the bags and the maximum reading associated with each sample will be recorded in the field notebook. Results of the field screening will be utilized to assist with determining which soil samples will be submitted for laboratory analyses.

The samples will be hand-delivered to TestAmerica in Seattle under standard chain of custody protocol. As a quality control measure, a trip blank sample will accompany the soil samples scheduled for volatile analyses during the entire sampling and handling process. One duplicate soil sample will be submitted for laboratory analyses. All soil cuttings will be stored onsite in a 55-gallon drum that will be clearly labeled as containing potentially contaminated soil and with contact information for the City of Othello, and the borings will be backfilled with the soil cuttings.

ESN will install a temporary monitoring well in three of the soil borings, as depicted on Figure 2. The wells will consist of 2-inch diameter, pre-packed Schedule 40 polyvinyl chloride (PVC) well screens coupled to riser pipe, such that a minimum of 2 feet of water will be present within the well for sampling. Upon installation of the new wells, BGES will survey the wells for top of casing elevations to the nearest 0.01 foot in order to calculate the groundwater gradient and flow direction. BGES will measure the depth to water and the total depth of each monitoring well using an electronic water level indicator that will be decontaminated prior to use.

Prior to sample collection, one well volume will be removed from each well using a positive displacement bladder pump equipped with a new bladder and new polyethylene tubing. The bladder pump will be decontaminated prior to use. The intake of the bladder pump will be set within 12 inches of the water table and the samples will be collected using low-flow sampling methodology. The flow rate during purging and sampling will be between 50 and 500 milliliters per minute (mL/min) and the purge water will be placed in a five-gallon bucket. During purging, the depth to water will be monitored in the well to verify that the drawdown is less than 0.3 foot. The water sample will be collected directly into laboratory-supplied containers, and the samples for volatile analyses will be collected first. Care will be

exercised to avoid spilling the preservative, and that no headspace remains within the vials destined for volatile analyses. As a quality control measure, a trip blank sample will accompany the water samples slated for volatile analyses during the entire sampling and handling process. A duplicate groundwater sample will also be submitted for laboratory analyses. The groundwater samples will be labeled, placed in a chilled cooler, and hand-delivered to TestAmerica in Seattle under standard chain of custody protocol. After collection of the groundwater samples, ESN will remove the wells from the ground and backfill the soil borings with the soil cuttings.

The 5-gallon buckets containing purge water from each of the three monitoring wells will be placed in a 55-gallon drum, which will be labeled as containing potentially contaminated water with contact information for the City of Othello. These drums will be temporarily stored onsite pending laboratory analyses.

In accordance with DOE requirements, the labels on each 55-gallon drum containing the soil cuttings, purge water, and decontamination water will also include identification of the soil boring or monitoring well associated with the waste, the date the waste was generated, and the name of the drilling company. Upon receipt of the laboratory analytical results, the appropriate disposal method can be selected and BGES will be available to coordinate disposal of these wastes upon request.

Other investigation-derived waste (IDW) will include used personal protective equipment (PPE), empty methanol vials, monitoring well materials, tubing, soils (if contamination is observed) and purge water. The used PPE, empty methanol vials, monitoring well materials, and tubing will be disposed of in the local landfill upon completion of the above-described soil and groundwater investigation activities.

#### Task 3 – Laboratory Analyses

The soil and groundwater samples collected from the subject property will be submitted to TestAmerica; a DOE-approved laboratory, for analysis of volatile petroleum products (gasoline) by Method NWTPH-Gx; semi-volatile petroleum products (diesel) by Method NWTPH-Dx; volatile organic compounds (VOCs) by Environmental Protection Agency (EPA) Method 8260D; 1,2,3-trichloropropane, 1,2dibromo-3-chloropropane, and 1,2-dibromoethane by EPA Method 8011; Model Toxics Control Act (MTCA) Metals (cadmium, total chromium, lead, nickel, and zinc) by EPA Method 6020; polynuclear aromatic hydrocarbons (PAHs) by EPA Method 8270D SIM; and polychlorinated biphenyls (PCBs) by EPA Method 8082A. It should be noted that this is not an exhaustive list of potential contaminants; however, these constituents were selected because they are most commonly associated with petroleum/waste oil products and are required by the DOE. Relevant Standard Operating Procedures Page 4 of 8 20-077-02R1 (SOPs) and holding times are provided in Attachment 2.

A Level 2 data package will be requested from the laboratory on a standard 10 business-day turnaround time. Because the groundwater samples will be collected from temporary monitoring wells, the analytical results associated with the groundwater samples will be considered "screening level" data.

The trip blanks will be analyzed for gasoline and VOCs by the methods listed above to evaluate the potential for cross-contamination of the samples to have occurred.

# Task 4 – Report

Upon receipt of the laboratory analyses, we will prepare a report of our findings and enter all of the obtained data into the DOE's online data management system. The report will include a discussion of the field activities, variances from the work plan (if any), laboratory results, and data quality; figures showing the locations of the soil borings, monitoring wells, and other pertinent site features; and tables of the laboratory data. The findings of the archaeological review, field notes, photographs of project activities, a conceptual site model, and the complete laboratory report(s) will be provided in appendices to our report. The report will also include recommendations for additional assessment and/or remediation activities as applicable, and rough order of magnitude costs for these activities.

#### Task 5 – Phase I ESA Update

Because the Phase I ESA dated October 2020 will expire before completion of the above-described activities, BGES will prepare an updated Phase I ESA. Our scope of work includes research, a site visit, and preparation of a report summarizing our findings. During the research phase of our assessment, we will contact numerous entities that may have knowledge of current and/or former site conditions. This information is typically obtained from a subset of the following sources: The Adams County Auditor's office; the tax assessor's office; the City of Othello's Clerk's office; the Washington Department of Ecology's Spills Maps, Contaminated Sites database, Leaking Underground Storage Tank (UST) database, etc.; the US Environmental Protection Agency's (USEPA) National Priorities List (NPL); the USEPA's Delisted NPL Sites; The USEPA's Federal List of Institutional Control Sites; the USEPA Environmapper database; the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database; the USEPA's CERCLIS No Further Remedial Action Planned List; the USEPA Corrective Action Detail Reports; The USEPA Region 10 Treatment, Storage, and Disposal facilities list; the USEPA Toxic Release Inventory System, Sanborn Fire Maps; The National Response Center; Polk City Directories; planning and zoning maps; water well surveys; the local electric companies; the local water and wastewater utility (if any); the local natural gas company; current and

former site owners; neighboring property owners or occupants; and other persons knowledgeable about the property.

The historical aerial photographs included in the Phase I ESA dated October 2020 will be included in the updated Phase I ESA. For efficiency, we have assumed that the site reconnaissance can be performed concurrently with the soil and groundwater assessment activities described above.

Upon completion of the above-described activities, we will prepare a written report of our findings for the subject property. We will include an opinion of the potential for contamination on the property, both from potential on-site and off-site sources; and identify recognized environmental conditions with respect to the subject property. We will also provide recommendations for additional activities if warranted.

# **PROJECT PERSONNEL**

Personnel associated with this project are listed in the following table.

Name/Organization	Responsibilities	Contact Information
Ali Furmall, Department of	Provide regulatory oversight of	Ali.furmall@ecy.wa.gov
Ecology	project activities	(509) 655-0538
David Moore, USACE	Provide Joint Aquatic Resources Permit	David.j.moore@usace.army.mil
		(206) 316-3166
Shawn Logan, Mayor of	Project Owner – authorize project	slogan@othellowa.gov
Othello	activities	(509) 488-5686
Thalia Lemus, City of	Grant Administrator – provide	tlemus@othellowa.gov
Othello	administrative support	(509) 488-5686
Bob Braunstein, BGES	Contract Manager	bob@bgesinc.com
		(907) 644-2900
Rose Pollock, BGES	Field Sampler – perform field	rose@bgesinc.com
	activities and provide subcontractor oversight	(206) 304-7956
Garth Baldwin, Drayton	Perform archaeology survey	garth@draytonarchaeology.com
Archaeology		(360) 739-3921
Anisa Harnden, ESN	Drilling contractor – advance soil	anisa@esnnw.com
Northwest, Inc.	borings and install monitoring wells	(360) 459-4670
Kristine Allen, TestAmerica	Provide laboratory analyses of soil and groundwater samples	Kristine.allen@eurofinset.com
		(253) 433-0390

# **PROJECT SCHEDULE**

We have developed the preliminary schedule shown below to assist you with planning for project completion. This schedule is an estimate and is dependent upon review and approval of our work plan, and the availability of our subcontractors.

Submit Joint Aquatic Resources Permit Application to USACE	April 12, 2021
Submit Revised Work Plan to DOE	April 19, 2021
Obtain DOE Opinion of Work Plan	April 30, 2021
Receive Joint Aquatic Resources Permit from USACE	May 12, 2021
Task 1 – Cultural Resource Records and Pedestrian Survey	April 20 – 21, 2021
Task 2 – Coordinate Utility Locates	May 13 – 14, 2021
Soil and Groundwater Assessment	May 17 – 18, 2021
Task 3 – Laboratory Analyses	May 19 – June 1, 2021
Task 4 – Submit Site Characterization Report	June 25, 2021
Task 5 – Submit Updated Phase I ESA	June 25, 2021

For your convenience, we have included an approval block on the following page. We look forward to working with you towards the successful completion of this project. If you have any questions concerning our work plan, please do not hesitate to contact us.

Sincerely,

#### **BGES, INC.**

Prepared by:

da

Lisa Vitale Environmental Scientist I

Reviewed by:

Robert h. Broumsterni

Robert N. Braunstein, C.P.G.; P.G. Principal

Encl.: Figure 1 – Site Map and Planned Sampling Locations
 Figure 2 – Planned Sampling Locations
 Attachment 1 – Site-Specific Health and Safety Plan
 Attachment 2 – TestAmerica SOPs and Holding Times

# WORK PLAN AUTHORIZATION:

I have reviewed this work plan for the Limited Phase II ESA and Phase I Update for the Truman Property in Othello, Washington. I approve of the planned activities presented in the work plan with the following modifications/additional comments, if applicable:

Signature, Department of Ecology

Signature, City of Othello

Date

Date



 

 0
 500
 1000
 2000

 Approximate Scale in Feet

 Parcel 2529040120001 Othello, Washington

 O Location of planned soil boring to evaluate potential contaminant migration from railroad operations

 BGES, INC.
 April 2021

 Figure 1



# ATTACHMENT 1 SITE-SPECIFIC HEALTH AND SAFETY PLAN



# BGES, INC.

TRUMAN PROPERTY OTHELLO, WASHINGTON

SITE-SPECIFIC HEALTH AND SAFETY PLAN

**APRIL 2021** 

**Prepared by:** 

BGES, INC. 1042 East 6<sup>th</sup> Avenue Anchorage, Alaska 99501 Phone: (907) 644-2900 Fax: (907) 644-2901 *WWW.BGESINC.COM* 

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- Attachment 2: Map to Hospital
- Attachment 3: Safety Data Sheets (SDSs)
- Attachment 4: NIOSH Fast Facts for Protecting Yourself from Heat Stress

# SECTION A - HEALTH AND SAFETY POLICY AND ADMINISTRATION STATEMENTS

# HEALTH AND SAFETY POLICY:

Braunstein Geological and Environmental Services, Inc. (BGES) is committed to providing a safe and healthy work environment for its entire staff, any subcontractors, and any site visitors. In pursuit of this endeavor, it is our company's policy to comply with applicable safety and health regulations and overall health and safety guidelines in accordance with 29 Code of Federal Regulations (CFR) 1910.120, Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard and 29 CFR 1926, Safety and Health Regulations for Construction.

This Site-Specific Health and Safety Plan (Plan) is a minimal standard for management, supervisory personnel, and employees. It assigns responsibilities and establishes standard operating procedures for hazard evaluation, employee and supervisor training, program enforcement, accident investigation, and record keeping. This Plan also provides field personnel with specific information regarding the hazards he/she may be exposed to at this site. This Plan was developed primarily for BGES employees; it is recommended that all other project personnel follow a Health and Safety Plan prepared by their respective organizations, in addition to this one; with the most stringent requirements applying in the case of any conflicting guidelines.

Attachments to this Health and Safety Plan include the following:

- Attachment 1 Health and Safety Plan Acknowledgement Form
- Attachment 2 Map to Hospital
- Attachment 3 Safety Data Sheets (SDSs)
- Attachment 4 NIOSH Fast Facts For Protecting Yourself From Heat Stress

# The Health and Safety Officer's responsibilities include, but are not limited to, the following:

- Conducting a daily health and safety briefing prior to beginning work activities.
- Conducting inspections of the work areas and operations to identify and initiate action to correct and document unsafe work practices or conditions.
- Encouraging project personnel to report any unsafe conditions or work practices.
- Instructing new personnel in the recognition and avoidance of, or protection from hazards.
- Halting operations if there is the potential for project personnel's overexposure or injury.
#### **Project Personnel responsibilities are as follows:**

- Obeying safety instructions, rules, regulations, policies, and procedures.
- Using and maintaining personal protective equipment (PPE) and safety devices provided or required.
- Reporting any unsafe conditions, work practices, or defective PPE to the Health and Safety Officer.
- Notifying the Health and Safety Officer and/or Project Manager if the project personnel experiences signs/symptoms of health issues during the course of daily activities, with special attention to adverse effects when using PPE.
- Offering suggestions for improvement of established programs and procedures.

#### Subcontractors are responsible for:

- Providing safe working conditions and procedures for their employees; including, but not limited to, conducting daily equipment inspections and performing traffic management (as applicable) during the performance of required tasks for this project.
- Working within the scope of the subcontract and performing that work in accordance with all applicable laws, regulations, the subcontractor's written health and safety programs, and specifications of the prime contract.
- Providing qualified equipment operators for the performance of required tasks for this project.
- Informing BGES, Inc. of any hazardous conditions created by its operations.
- Participating in the required health and safety meetings held by BGES, Inc. (where applicable) when work within the scope of the subcontract is in progress.

#### **PROJECT ORGANIZATION AND CONTACT INFORMATION:**

Overall contract/project management will be the responsibility of BGES. BGES will have the ultimate authority to determine if the project activities can be completed in a safe manner. The BGES Principal and Corporate Health and Safety Officer is Robert Braunstein and he can be contacted at (907) 644-2900 (office) or (907) 830-9560 (cell phone).

The BGES on-site Health and Safety Officer and Project Manager for this project will be Rose Pollock. Ms. Pollock can be reached via cell phone at (206) 304-7956. The following list is provided as a more convenient reference of the contacts described above and includes other individuals/organizations that may also be contacted as needed.

- Emergencies: 911
- Othello Police Department (non-emergency): (509) 488-3314
- Othello Fire Department (non-emergency): (509) 488-2951

- Othello Community Hospital, 315 N. 14th Avenue, Othello: (509) 488-2636
- BGES Corporate Health and Safety Officer: Robert Braunstein (907) 830-9560 (cell)
- BGES Project Manager & Field Personnel: Rose Pollock (206) 304-7956 (cell)
- BGES Office: (206) 569-4554

#### SITE-SPECIFIC PLAN TRAINING:

To ensure that all employees and onsite subcontractors have read and understand the information contained in this Plan, the Health and Safety Officer will:

- Provide project personnel with this plan and instruct these personnel to read it and sign the acknowledgement page (Attachment 1).
- Be available for questions.
- Conduct daily health and safety briefings prior to each day's field activities.

#### **PROJECT DESCRIPTION:**

The field work for the assessment and potential remediation of contaminated soils and debris will be performed by, or under the direct supervision of an experienced Environmental Scientist.

BGES conducted a Phase I ESA of the subject property in October of 2020 and identified a recognized environmental condition stemming from staining and free product on the central portion of the property, and the potential for contamination to exist in surface and subsurface soils at quantities and concentrations that would be deemed actionable by the Washington Department of Ecology (DOE). The objectives of the field activities are as follows:

- Characterize potential soil and groundwater contamination;
- Evaluate the extent of contamination; and,
- Evaluate the potential for contamination to be migrating from the east.

### **SECTION B - ACCIDENT PREVENTION AND SAFETY PROCEDURES**

#### **INTRODUCTION:**

This section of the Plan will help project personnel understand and comply with the safety requirements of 19 CFR 1910.120 and 29 CFR 1926. It is important that each project personnel understands how each activity, or task, is to be performed safely. It is the responsibility of each worker to ask questions when uncertain about instructions before beginning work. Communication is a key aspect of safety. Effective

communication must be maintained between supervisors, co-workers, and any others affected by their actions. Before beginning any job, workers will be familiarized with the people affected by the job, the hazards associated with that job, and how to avoid injury.

#### **POTENTIAL CHEMICAL HAZARDS:**

The most common potential chemicals that may be encountered during the site assessment activities for this project include, but are not limited to, the following: diesel range organics (DRO), gasoline range organics (GRO), isobutylene calibration gas, methanol (sample preservative), polynuclear aromatic hydrocarbons (PAHs), residual range organics (RRO), metals, and volatile organic compounds (VOCs). Additional information concerning chemical hazards is included in Section D below.

#### **PERSONAL PROTECTIVE EQUIPMENT (PPE):**

<u>General Information.</u> PPE can provide a last defense against exposure and injury when other hazard control measures have failed. Project personnel are responsible for using necessary apparel and equipment, and maintaining it in good working condition. The Health and Safety Officer will take measures to minimize the potential that project personnel are not exposed to hazards by:

- 1. Evaluating operations for hazards.
- 2. Determining which PPE should be used for each identified hazard.
- 3. Informing employees of the PPE requirements in initial training and when hazards change.

<u>PPE Categories.</u> PPE is divided into four categories based on the degree of protection necessary based on site conditions. Level A provides the greatest level of chemical protection available. Level B should be used when the maximum level of respiratory protection is necessary, but a lesser level of skin protection is required. Level C provides less skin and respiratory protection than either Levels A or B. Level D provides no respiratory protection and low protection against chemical contact.

Based on known conditions at the project site, Level D PPE will initially be required for the performance of the tasks for the completion of this project. The Level D PPE will consist of typical work clothes and may include hard hat, steel-toed boots, safety glasses or goggles, chemical resistant gloves, leather gloves, and/or safety vest, depending on the specific tasks being performed. Additional information is presented below for Level D PPE and related field tasks. Should the need arise to upgrade to Level C protection, as determined by BGES' on-site Health and Safety Officer, then a respirator and a chemical resistant suit

will be available and utilized. If conditions are encountered that would require a further upgrade to Level B protection, the work will temporarily cease and additional planning will be undertaken.

Because of the typical weather conditions in the region of the subject property, project personnel may be subjected to hot weather conditions for extended periods of time. Some risks of working in this warm region include, but are not limited to heat stress and heat stroke. All project personnel should dress appropriately for the weather, drink plenty of fluids, and maintain a direct line of sight with other project personnel at all times. Additional information regarding weather-related hazards is provided below in Section D.

# Based on hazard and exposure assessments, the required/recommended PPE for BGES, subcontractors, and visitors at this site are as follows:

Head and Scalp. Hard hats must be worn when work is performed under the following circumstances:

- Under or near, or working with drilling rigs, excavators, forklifts, loaders, trucks, jackhammers, or any other equipment that is handling materials, and where equipment is stored overhead.
- In any other areas designated by BGES, where there is a potential for head injury.

Eyes, Face, Neck, and Body. Industrial grade safety goggles (impact), coverall goggles (chemical), welding goggles, full-face shields, and/or other appropriate eye protection must be worn to protect employees from eye damage when:

- Working with chemicals that could splash;
- Workers are performing:
  - Hazardous Waste Excavation;
  - Chemical Sampling;
  - Hazardous Waste Operations;
  - Work with various hand tools;
  - Fueling operations
- Other work tasks that can injure your eyes.

All new project personnel are to be informed of the specific locations of applicable eye protection. All project personnel and visitors must wear high visibility safety vests when on the project site and specifically when working around heavy equipment and trucks.

<u>Fingers, Hands and Wrists.</u> Hands must be protected when necessary to prevent abrasion, burns, cuts, chemical absorption, biological hazards, and other hand injuries. Therefore, appropriately-selected gloves must be worn to protect project workers' hands and wrists from the hazards associated with:

- Excavation work (impact protective leather);
- Drilling activities (impact protective leather);
- Chemical Sampling (chemical protective);
- Hazardous Waste Operations (chemical protective);
- Fueling operations (chemical protective);

<u>Legs</u>, <u>Thighs</u>, <u>Knees</u>, <u>Shins and Ankles</u>. Wear appropriate clothing for the job task assigned. Overalls or pants must not have loose, torn or dragging fabric. Shin guards, chaps, spats, etc., should be considered when using powered tools. For this project, protective clothing will include Level D, such that the employee is protected from physical hazards at the job site. Shorts and short-sleeve shirts should not be worn at this site. In addition, flying insects may be a nuisance at this project site. Personnel may use insect repellent and/or mesh netting to minimize contact with insects.

<u>Feet and Toes.</u> Generally, for work in an environment that exposes the worker to the possibility of foot injury due to falling or rolling objects or objects piercing the sole, or electrical hazards, safety-type footwear (steel-toe boots that meet Occupational Safety and Health Administration's (OSHA's) 1910.136 and ASTM F-2413-17 Standard Specification for Performance Requirements for Protective Footwear) must be worn. This includes maintenance work on machinery that could result in injury. For this project, steel-toed boots will be required.

All employees must wear safety shoes when:

- Working around an operational drilling rig, excavator, or other heavy equipment;
- Changing cutting edges on equipment and removing manhole covers (two man operations);
- Before stepping into spots where material could shift and pin the legs or feet, it is important that stability be considered; or
- Other situations where feet/toes need protection.

#### **TOOL SAFETY:**

<u>Hand Tools.</u> Of the equipment placed at our disposal, common hand tools are the most useful and most often abused pieces of equipment. It is commonly known that many construction injuries are caused by hand tools. Where hand tools are used, the following safety rules will be observed:

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- 1. Choose the right tool for the job and never use a makeshift setup;
- 2. Apply working force in a direction away from the body to minimize injury if the tool slips;
- 3. Do not misuse tools and equipment by performing unsafe practices;
- 4. Ensure that the tool handles are fitted to tools and secured properly. Make sure that tools are free from grease and other foreign substances before use;
- 5. Dress cold chisels, hammers, drift pins, and other tools that have a tendency to mushroom at the head. A light radius [approximately 3/16" (4.7 mm)] should be ground on the edge of the head;
- 6. Do not carry sharp-edged or pointed tools in clothing pockets. Store them safely when not in use;
- 7. Do not run or climb when holding tools in your hands. Point the sharp end of tools away from the body when transporting them;
- 8. Do not use defective tools, such as open-end or adjustable wrenches with spring jaws, pipe wrenches with dull teeth, or knives with dull blades;
- 9. Do not use a pipe or other extension, on a wrench handle to increase the leverage unless the wrench is specifically designed for that purpose;
- 10. Do not use rulers or metal tapelines near energized electric conductors or equipment;
- 11. Equip files or other tools with pointed tangs with suitable handles;
- 12. Wear a face shield or impact goggles when assigned tasks that may produce flying chips or particles;
- 13. Do not apply hand tools to moving machinery, except tools designed for that purpose that are necessary in the operation;
- 14. Do not throw tools or other materials from one employee to another or from one location to another. A suitable container must be used for lowering or raising small equipment or tools between different elevations;
- 15. Handle tools with care. If tools are found to be defective, take out of service and repair them or tag them for future repair or disposal; and
- 16. Read all manufacturer's instructions and/or manuals prior to using the tools.

<u>Power Tools.</u> Power tools shall be inspected, tested, and determined to be in safe operating condition before using. All power tools must be guarded at the point of operation if the operation could expose the operator or employee to injury. Project personnel will read manufacturer's instructions and/or manuals prior to using both specialized hand and power tools.

Portable power tools present hazards similar to those presented by stationary machinery in addition to the risk of handling. Sources of injury include shock, particles in the eyes, fires, falls, explosion of gases, cuts and abrasions, and falling tools. The following general guidelines will be followed:

1. Always disconnect the power lines before changing the accessories on a portable tool, replace the guards, and make the correct adjustment before the tool is used again.

- 2. Power lines will be suspended over the work areas or placed in such a way as to prevent the line from being struck by people or materials moving through the area. Power lines will be kept away from sharp edges, oils, hot surfaces, and chemicals. Power lines that are frayed or otherwise in poor physical condition will not be used.
- 3. Powered equipment will not be used in significantly wet conditions.

For this project, power hand tools are not anticipated to be used.

#### **HEARING PROTECTION:**

Hearing protection is required for employees working in areas where noise is considered to exceed recommended safe sound levels. When there is any doubt about the level of noise at a work site, personnel should utilize caution and wear appropriate hearing protection.

#### DRILLING RIG, HEAVY EQUIPMENT, AND TRUCK OPERATION SAFETY:

The subcontractor will provide qualified operators that have been trained on the equipment they will use. At the beginning of each day, the drilling rig, each piece of heavy equipment, and/or truck will be inspected to make sure that they are in safe operating conditions. If necessary, the equipment will be repaired to replace any defective parts prior to use. All vehicles and heavy equipment must have a brake system; working lights; horn; and a backup alarm. The following safety measures should be followed when moving heavy equipment and trucks:

- Make sure there is a spotter to keep people out of the area and to guide the operator when necessary.
- Be aware of any overhead obstructions, like power lines, trees, or buildings.
- If you don't have a clear view, walk around the heavy equipment and/or trucks to check for obstructions.
- Make sure the truck is not overloaded.
- Make sure the load is secured, covered, and stable before moving the truck.

When working around drilling rigs, heavy equipment, and moving trucks, the most important safety points to remember include the following:

- Stay alert at all times.
- Keep a safe distance from the drill rig, heavy equipment, and/or truck. If you need to move within the working zone of the drill rig, equipment, or truck, **first make eye contact** with the operator/driver and confirm that they know you are entering their work zone.
- Keep off the equipment unless authorized.
- Wear a bright vest or jacket when working near moving drill rig, vehicles, or heavy equipment.

- Stay clear of dumping or lifting devices.
- Set up a system onsite to control the traffic flow of trucks from the work zone to the public street. If necessary, use traffic cones, barricades, warning signs, and/or flaggers.
- Furthermore, restrict public entry to the job site using tape, fencing, signs, etc. to delineate areas that are off-limits to public access.

#### SECTION C - PERSONAL INJURY AND ACCIDENT PROCEDURES

If an employee of BGES or one of its contractors is involved in an accident or are injured on the job, use the following procedures:

If the injury does not require response beyond first aid, the injury will be treated and documented.

If the injury does require response beyond first aid, employees and/or the health and safety officer will call 911 for ambulance and/or police. The route to the nearest hospital (Othello Community Hospital) for this project is as follows:

Exit the site by heading east on Cunningham Road, which becomes Main Street (Attachment 2). Follow for approximately 1.2 miles, then turn left onto N. 14<sup>th</sup> Avenue and follow that for 0.2 mile. Turn left into the Othello Community Hospital parking lot and follow signs toward the emergency room entrance.

After the injured person is placed in the care of a professional health care provider(s), the BGES' Health and Safety Officer will call the BGES Principal/Corporate Health and Safety Officer and the BGES Project Manager as soon as possible. The BGES Principal or Project Manager will then notify the City of Othello.

If an accident results in a death, the project personnel shall immediately call the BGES' Corporate Health and Safety Officer and/or the BGES Project Manager (after contacting emergency services). If a project worker receives a moving motor vehicle violation notice, the personnel must not move or operate equipment, must be prepared to take a drug and alcohol test, and must notify the BGES Corporate Health and Safety Officer immediately. If there is a fatal injury, project personnel will secure the site and make it safe.

Project personnel will immediately request a police investigation and notify the BGES Corporate Health and Safety Officer if:

- A fatality occurred
- A vehicular injury occurred
- A vehicular accident in a public roadway occurred
- A vehicular accident that caused damage to private property occurred

All accidents resulting in immediate or probable fatality of or when at least one person is hospitalized overnight will be reported to the nearest OSHA office within eight hours by BGES, Inc. This report shall be made orally with a follow up written report to the office. The report must include the details of the accident, including but not limited to:

- The circumstances of the accident
- The number of fatalities
- Extent of any injuries

When there is a fatality or overnight hospitalization, any equipment, material, or related evidence that might help with an investigation will not be moved except to prevent further accident.

All records relating to an accident shall be kept for at least five years from the end of the year in which it occurred (i.e., up to six years total). When requested by Department of Labor and Workforce Development, BGES, Inc. will participate in the industrial evaluation of occupational accidents.

#### **SECTION D - HAZARD EVALUATION**

# SAFETY DATA SHEETS (SDSS), LABELS, WARNING PROCEDURES: GENERAL STATEMENT:

In general, chemical exposures may cause or contribute to many serious health effects such as heart ailments, kidney and lung damage, sterility, cancer, burns, headaches, and rashes. Additionally, some chemicals present safety hazards such as fires, explosions, and other serious accidents. Therefore, these site-specific procedures are designed to reduce the incidences of exposures to chemical sources that contribute to illness and injury in the workplace. Those employees who handle, use, or dispose of hazardous chemicals are required to comply with the work practices outlined in these procedures.

#### **GENERAL SITE CONDITIONS:**

The sources of the potential contamination are reportedly staining and free product on the central portion of the property to be investigated. The potential impact on groundwater has not yet been defined. The primary goals of this project are to characterize the soils and groundwater.

#### CHEMICAL HAZARD EVALUATION:

The potential chemicals/substances that may be encountered during the site assessment activities for this project site include, but are not limited to, the following: DRO, GRO, isobutylene (calibration gas), methanol (sample preservation), PAHs, RRO, VOCs, and metals. The hazard evaluation for each of these chemicals is presented in Table 1 below. During the drilling and sampling activities, soil samples will be screened utilizing a photoionization detector to monitor for volatile organic compounds.

Chemical	OSHA Permissible Exposure Limit (TWA)	Exposure Routes	PPE
Gasoline	300 ppm	Inhalation, skin absorption, ingestion, and skin and/or eye contact	Nitrile or similar gloves; safety glasses or goggles; wash skin after it becomes contaminated; at the end of each work shift; and before eating, drinking, smoking, etc.
Benzene	1.0 ppm	Inhalation, skin absorption, ingestion, and skin and/or eye contact	Nitrile or similar gloves; safety glasses or goggles; wash skin after it becomes contaminated; at the end of each work shift; and before eating, drinking, smoking, etc.
Toluene	200 ppm	Inhalation, skin absorption, ingestion, and skin and/or eye contact	Nitrile or similar gloves; safety glasses or goggles; wash skin after it becomes contaminated; at the end of each work shift; and before eating, drinking, smoking, etc.
Ethylbenzene	100 ppm (435 mg/m <sup>3</sup> )	Inhalation, ingestion, and skin and/or eye contact	Nitrile or similar gloves; safety glasses or goggles; wash skin after it becomes contaminated; at the end of each work shift; and before eating, drinking, smoking, etc.
Total Xylenes	100 ppm (435 mg/m <sup>3</sup> )	Inhalation, skin absorption, ingestion, and skin and/or eye contact	Nitrile or similar gloves; safety glasses or goggles; wash skin after it becomes contaminated; at the end of each work shift; and before eating, drinking, smoking, etc.
Polynuclear Aromatic Hydrocarbons	0.2 mg/m <sup>3</sup>	Inhalation, skin absorption, ingestion, and skin and/or eye contact	Nitrile or similar gloves; safety glasses or goggles; wash skin after it becomes

 Table 1. Hazard Evaluation for Chemicals

Chemical	OSHA Permissible Exposure Limit (TWA)	Exposure Routes	PPE		
			contaminated; at the end of each work shift; and before eating, drinking, smoking, etc.		
Diesel exhaust	NA	Inhalation, and skin and/or eye contact	Work upwind whenever possible.		
Diesel	NA	Inhalation, Ingestion, and skin and/or eye contact	Nitrile or similar gloves; safety glasses or goggles; wash skin after it becomes contaminated; at the end of each work shift; and before eating, drinking, smoking, etc.		
Hydrochloric Acid	Ceiling = 5 ppm	Inhalation, Ingestion, and skin and/or eye contact	Nitrile or similar gloves; safety glasses or goggles; wash skin after it becomes contaminated; at the end of each work shift; and before eating, drinking, smoking, etc.		
Methanol	200 ppm (260 mg/m <sup>3</sup> )	Inhalation, absorption, ingestion, and skin and/or eye contact	Nitrile or similar gloves; safety glasses or goggles; wash skin after it becomes contaminated; at the end of each work shift; and before eating, drinking, smoking, etc.		
Isobutylene	NA	Inhalation	Use in a well-ventilated location		
Lead	50 µg/m <sup>3</sup>	Inhalation and ingestion	Nitrile or similar gloves; safety glasses or goggles; wash skin after it becomes contaminated; at the end of each work shift; and before eating, drinking, smoking, etc.		
Antifreeze (ethylene glycol)	50 ppm	Inhalation, ingestion, and skin and/or eye contact	Nitrile or similar gloves; safety glasses or goggles; wash skin after it becomes contaminated; at the end of each work shift; and before eating, drinking, smoking, etc.		

**Notes:** PPE = personal protective equipment; ppm = parts per million; mg/m<sup>3</sup> = milligrams per cubic meter; NA = not available; and TWA = time weighted average;  $\mu g/m^3$  = micrograms per cubic meter.

Permissible exposure limit pertains to the Occupational Safety and Health Administration (OSHA) guidelines [Source: National Institute for Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards or Safety Data Sheets]

#### SAFETY DATA SHEETS (SDS):

The Health and Safety Officer will acquire and maintain appropriate SDS for each chemical that presents a potential health or physical hazard. Employees will be informed about the location and use of the SDS. The Health and Safety Officer will periodically review all SDSs to ensure the file remains current. Copies of the SDSs for this project are presented in Attachment 3.

#### LABELS:

Each container that stores a chemical that could pose a potential health hazard will be labeled to show the name of the product. Information concerning hazards, preventative measures, signs of exposure, and in some cases, manufacturer's information is contained in the SDS as described above. When portable

containers are used to transport or transfer hazardous materials, then these containers will be similarly labeled.

Project personnel will not remove or deface existing labels on incoming containers. All labels will be legible at all times, be in English, and will prominently display all appropriate information. Project personnel will follow all manufacturers' label information regarding use, storage, handling, and disposal of materials, as applicable.

#### **BIOLOGICAL HAZARDS:**

Rodents, pathogenic microorganisms, and viruses are potential biological hazards of concern. The primary threats associated with these hazards are receiving bodily harm, bites, and/or contracting disease. The threats associated with these hazards include flesh wounds and/or infections. All open wounds will be cleaned and treated with an appropriate dressing to avoid infection; and medical attention will be sought as required.

#### **COVID-19 SPECIAL REQUIREMENTS:**

During the Covid-19 pandemic, special precautions are necessary to protect the health of employees and other project personnel as well as the public. BGES personnel will maintain social distancing as recommended by state and federal agencies. In addition, BGES personnel will wear a mask whenever social distancing cannot be maintained during project activities or travel. Furthermore, BGES personnel will follow any current federal, state, or local requirements for Covid-19 testing, travel, or other activities that have been promulgated at the time of project activities.

#### **PHYSICAL HAZARDS:**

Physical hazards include, but are not limited to slipping on wet surfaces; tripping over equipment, natural features, or other items; falling off of equipment or ladders; and exposure to hot temperatures. Cold stress is not anticipated to be a concern for this project because of the local climate of the project site at the time that this work will be performed. Information regarding heat stress, published by the Centers for Disease Control and Prevention (CDC) and NIOSH, is presented in Attachment 4. Each worker should review this and make sure that they protect themselves and their coworkers from heat stress.

To avoid slipping, personnel will wear boots with good traction. When walking on wet surfaces, personnel should maintain their body weight in a vertical manner (keeping their feet underneath them as much as Page 13 of 16 20-077-03

possible) and using small steps. The potential for tripping over items at the site will be reduced by keeping materials and equipment in an orderly manner. All personnel should be aware of their surroundings when moving about the site. Reading or writing, or talking on the phone while walking around should be avoided. If a ladder is utilized, it will be inspected before it is put into service and it will be stabilized with a no slip grip on the legs and secured to the side of the excavation, when possible. Personnel entering and exiting large equipment will take their time in doing so, and will be cognizant of the potentially slippery surfaces on the machinery, given the current weather and site conditions. If necessary, a buddy system will be employed to assist these individuals with this function.

While operating equipment or vehicles on the project sites, and offsite, all personnel are prohibited from engaging in activities that may distract the operator/driver. Such activities include writing, texting, checking emails, conducting internet searches, or any other tasks not related to driving that require hand-eye coordination.

#### SITE CONTROL:

A site control program is utilized to control the exposure of project personnel, subcontractors, and/or visitors to hazardous substances on the project site. A site control program for this project will include the establishment of work zones, site communications, identification of the nearest hospital, and adhering to safe work practices.

<u>Work Zones.</u> Work zones will be established in the field and will surround the potentially contaminated areas to be assessed in the vicinity of the soil boring locations. Work zones typically consist of the exclusion zone, the contamination reduction zone, and the support zone. However, in this case, it is not anticipated that formal contamination reduction and support zones will be necessary, because of the limited nature of project field activities. The exclusion zones will be established using traffic cones, temporary fencing, or visible tape where the safety of crews and the public may be threatened. These areas will be clearly demarcated with these materials so that entrance will only be permitted to authorized project personnel.

<u>Communications.</u> Site communications will consist of the establishment of hand signals between the equipment operator and the field technician. Additionally, a cell phone or a satellite phone will be on site for use in emergency situations.

<u>Hospital Map.</u> A map to the nearest hospital has been prepared and is included in Attachment 2 to this health and safety plan. During field activities, a copy of this map will be placed on top of the health and safety plan which will be located in an area visible and accessible to everyone. The specific location of the health and safety plan will be established during the daily health and safety briefings.

<u>Equipment Operations.</u> The subcontractor will provide qualified operators to operate the drill rig and other equipment utilized during the assessment activities. The equipment operator will perform routine daily equipment checks and maintenance as described above. The equipment will be operated in accordance with safe work practices and OSHA regulations. When equipment maintenance is required, the contractor will utilize lockout-tagout protocols to ensure that the power source is isolated and inoperative during maintenance. The operator will lock the power source such that the equipment may not be turned on, and s/he will carry the key to the lock during maintenance activities. Upon completion of the required maintenance, and prior to resuming field activities, the operator will unlock the power source.

#### **ENGINEERING CONTROLS AND WORK PRACTICES:**

Engineering and work practice controls will be the primary methods used to prevent or minimize exposure to chemicals. The specific engineering and work practice controls that will be used and where they will be used are listed below.

<u>Engineering Controls.</u> Project personnel will use and store chemicals in well-ventilated areas when specified on the product label or SDS.

<u>Work Practices.</u> Where feasible, project personnel will thoroughly wash their hands with water and soap prior to glove removal, after contact with chemicals or contaminated soil, and/or after the removal of gloves.

- Project personnel will immediately seek professional medical assistance if contact with chemicals or contaminants occurs.
- Chemicals will be properly stored as specified by the product label and/or the SDS.
- Project personnel will follow all appropriate handling information specified on the product's label and SDS.
- Project personnel will remove and properly launder or dispose of clothing if exposed to chemicals.

• Project personnel will not be permitted to handle chemicals if they have open lesions or weeping dermatitis until their condition is resolved.

<u>Electric Lines.</u> Project personnel will always survey the project site for electrical lines both overhead, to all sides, and below the work area prior to beginning any work with equipment that could come in contact with the lines, including subcontractor's equipment.

<u>Utility Locates.</u> The one-call utility locate center will be contacted prior to conducting any subsurface work. The numbers to call are: 811 or 1-800-424-5555. In addition, we will request identification of utilities from a local provider in the vicinity of the site, as applicable, and also from the property owner.

<u>Confined Space Entry.</u> Confined space entry will not occur at any project site without preparation and submittal of a confined space entry permit and the permission of the Supervisor or the Health and Safety Officer. Confined space entry is not required for this project, and is prohibited.

#### **MEDICAL EMERGENCIES:**

Should project personnel be exposed to a chemical or experience signs and symptoms of health problems, emergency medical personnel will be notified immediately; after which the Health and Safety Officer and the BGES Corporate Health and Safety Officer will be contacted immediately. The Health and Safety Officer and the BGES Corporate Health and Safety Officer will take direct action to protect the affected workers' safety.

The following information will be provided to the physician or other health care provider:

- How the exposure occurred and the route(s) of exposure;
- Identification of the hazardous chemical; and
- Information concerning the signs and symptoms of the exposure.

## **ATTACHMENT 1**

### HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT FORM

#### ACKNOWLEDGEMENT FORM FOR HEALTH AND SAFETY PLAN

I, \_\_\_\_\_, have read and understand the Site-Specific Health and Safety Plan developed for the assessment of contaminated soils and groundwater at the Truman Site in Othello, Washington.

Signature

Date

I, \_\_\_\_\_, have read and understand the Site-Specific Health and Safety Plan developed for the assessment of contaminated soils and groundwater at the Truman Site in Othello, Washington.

\_\_\_\_\_

 Signature
 Date

I, \_\_\_\_\_, have read and understand the Site-Specific Health and Safety Plan developed for the assessment of contaminated soils and groundwater at the Truman Site in Othello, Washington.

Signature

Date

I, \_\_\_\_\_, have read and understand the Site-Specific Health and Safety Plan developed for the assessment of contaminated soils and groundwater at the Truman Site in Othello, Washington.

\_\_\_\_\_

Signature

## **ATTACHMENT 2**

### MAP TO HOSPITAL



## ATTACHMENT 3

### SAFETY DATA SHEETS

UNOCAL CHEMICALS DIV UNION OIL CO OF CALIFORNIA -- ANTIFREEZE -- 6850-00-664-1403

Product ID:ANTIFREEZE MSDS Date:03/21/1989 FSC:6850 NIIN:00-664-1403 MSDS Number: BJPTD === Responsible Party === Company Name: UNOCAL CHEMICALS DIV UNION OIL CO OF CALIFORNIA Address:1345 N MEACHAM RD City:SCHAUMBURG State:IL ZIP:60195 Country:US Info Phone Num: 312-490-2539 Emergency Phone Num: 312-490-2539 CAGE: 5W323 === Contractor Identification === Company Name: UNOCAL CHEMICALS DIV UNION OIL CO OF CALIFORNIA Address:1345 N MEACHAM RD Box:City:SCHAUMBURG State: IL ZIP:60195 Country:US Phone:800-967-7601 CAGE: 5W323 Ingred Name: ETHYLENE GLYCOL (SARA III) CAS:107-21-1 RTECS #:KW2975000 Fraction by Wt: 92-97% Other REC Limits: NONE SPECIFIED OSHA PEL:C 50 PPM ACGIH TLV:C 50 PPM, VAPOR; 9192 EPA Rpt Qty:1 LB DOT Rpt Qty:1 LB Ingred Name: DIETHYLENE GLYCOL CAS:111-46-6 RTECS #:ID5950000 Other REC Limits: NONE SPECIFIED LD50 LC50 Mixture: ACUTE ORAL LD50 (HUMAN) IS 1500 MG/KG Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO Health Hazards Acute and Chronic: ACUTE: INGESTION: ABDOMINAL DISCOMFORT OR PAIN, NAUSEA, CENTRAL NERVOUS SYSTEM DEPRESSION. SEVERE KIDNEY AND LIVER DAMAGE FROM LARGE AMOUNTS; MAY BE FATAL. INHALATION: IRRITATION OF THE NOSE AND THROAT. EYE: DISCOMFORT WITH TRANSIENT CONJUNCTIVITIS. CHRONIC: INHALATION OF MIST MAY PRODUCE SIGNS OF CNS DISTURBANCES. Explanation of Carcinogenicity: NONE OF THE COMPOUNDS IN THIS PRODUCT IS LISTED BY IARC, NTP, OR OSHA AS A CARCINOGEN. Effects of Overexposure:MAY CAUSE DIZZINESS, MALAISE, LUMBAR PAIN, UREMIA, AND CENTRAL NERVOUS SYSTEM DEPRESSION. MAY CAUSE EYE, SKIN & RESPIRATORY TRACT IRRITATION. Medical Cond Aggravated by Exposure:PERSONS WITH A HISTORY OF KIDNEY OR LIVER DISORDERS MAYBE AT INCREASED RISK FROM EXPOSURE.

First Aid:INHALATION: REMOVE TO FRESH AIR. CALL A PHYSICIAN IF DISCOMFORT PERSISTS. EYE: IMMEDIATELY FLUSH EYES WITH PLENTY OF WATER FOR 15 MINUTES. CALL A PHYSICIAN. SKIN: WASH WITH PLENTY OF SOAP & WATER. REM OVE CONTAMINATED CLOTHING/SHOES. INGESTION: IF CONSCIOUS, GIVE 2 GLASSES OF WATER TO DRINK AND INDUCE VOMITING WITH IPECAC SYRUP-NOTHING BY MOUTH IF UNCONSCIOUS. CALL A PHYSICIAN IMMEDIATELY.

Flash Point Method:COC

Flash Point:250F,121C

Lower Limits:1.6

Upper Limits:10.8

- Extinguishing Media:USE CARBON DIOXIDE, FOAM, OR DRY CHEMICAL. WATER MAY BE INEEFECTIVE.
- Fire Fighting Procedures: FIRE FIGHTERS SHOULD USE NIOSH APPROVED SCBA & FULL PROTECTIVE EQUIPMENT WHEN FIGHTING CHEMICAL FIRE. USE WATER SPRAY TO COOL NEARBY CONTAINERS EXPOSED TO FIRE.
- Unusual Fire/Explosion Hazard:FIRE OR EXCESSIVE HEAT MAY CAUSE PRODUCTION OF HAZARDOUS DECOMPOSITION PRODUCTS. HEATED VAPORS MAY CAUSE FLASH BACK.

Spill Release Procedures:SMALL SPILL: WIPE/SOAK UP WITH PAPER TOWEL OR INERT ABSORBENT. PUT IN DISPOSAL CONTAINER. FLUSH RESIDUE WITH WATER. LARGE SPILL: VENTILATE AREA. IF POSSIBLE, STOP LEAK. DIKE TO RETAIN RUN OFF. VACUUM UP FREE LIQUID. FLUSH RESIDUE WITH WATER. Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER. WATER DILUTION RECOMMENDED.

- Handling and Storage Precautions:STORE IN A COOL, DRY, WELL VENTILATED AREA. KEEP CONTAINERS TIGHTLY CLOSED WHEN NOT IN USE. PROTECT CONTAINERS FROM PHYSICAL DAMAGE.
- Other Precautions:DO NOT TAKE INTERNALLY. DO NOT BREATHE MIST. AVOID PROLONGED OR REPEATED BREATHING OF VAPOR. AVOID CONTACT WITH EYES. USE WITH ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. FOR INDUSTRIAL USE ONLY.

======= Exposure Controls/Personal Protection ==========

- Respiratory Protection: IF VENTILATION DOES NOT MAINTAIN INHALATION EXPOSURES BELOW PEL(TLV), USE NIOSH/MSHA APPROVED ORGANIC VAPOR CARTRIDGE AND DUST/MIST PRE-FILTER RESPIRATORS AS PER CURRENT 29 CFR 1910.134, INSTRUCTIONS/ WARNINGS AND NIOSH-RESPIRATOR SELECTION.
- Ventilation:MECHANICAL (GENERAL) ROOM VENTILATION IS ADEQUATE IF USE IS ENCLOSED. LOCAL EXHAUST IS NEEDED IF VENTED INTO WORK AREA.

Protective Gloves: NEOPRENE, NITRILE, PVC OR NATURAL RUBBER Eye Protection: SAFETY GOGGLES WITH OPTIONAL FACE SHIELD Other Protective Equipment: EYE WASH STATION AND SAFETY SHOWER. INDUSTRIAL-TYPE WORK CLOTHING AND APRON AS REQUIRED. Work Hygienic Practices: OBSERVE GOOD PERSONAL HYGIENE PRACTICES AND RECOMMENDED PROCEDURES. DO NOT WEAR CONTAMINATED CLOTHING OR FOOTWEAR. Supplemental Safety and Health DO NOT TAKE INTERNALLY. DO NOT GET ON SKIN OR IN EYES. AVOID PROLONGED OR REPEATED BREATHING OF VAPOR. DO NOT BREATHE MISTS. WASH THOROUGHLY AFTER HANDLING AND BEFORE EATING OR DRINKING OR SMOKING OR USING REST ROOM. HCC:N1 Boiling Pt:B.P. Text: 330F, 166C Vapor Pres:0.06 @20C Vapor Density: 2.1 AIR=1 Spec Gravity:1.108 Solubility in Water:COMPLETE Appearance and Odor: CLEAR GREEN LIQUID - SLIGHT ODOR Percent Volatiles by Volume:NEG. Stability Indicator/Materials to Avoid:YES STRONG OXIDIZING AGENTS Stability Condition to Avoid: HIGH TEMPERATURES, SPARKS, AND OPEN FLAMES Hazardous Decomposition Products: CARBON MONOXIDE AND CARBON DIOXIDE Waste Disposal Methods: DISPOSAL SHOULD BE MADE BY INCINERATION IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL LAWS AND REGULATIONS. AT VERY LOW CONCENTRATIONS IN WATER, DISPOSE OF THIS MATERIAL IN A BIOLOGICAL W ASTE WATER TREATMENT PLANT. Disclaimer (provided with this information by the compiling agencies): This information is formulated for use by elements of the Department of Defense. The United States of America in no manner whatsoever, expressly or implied, warrants this information to be accurate and disclaims all liability for its use. Any person utilizing this document should seek competent professional advice to verify and assume responsibility for the suitability of this information to their

particular situation.

## BENZENE

**ICSC: 0015** 

BENZENE Cyclohexatriene Benzol C6H6					
		Mole	cular mass: 78.1		
CAS # 71-43-2 RTECS # CY1400000 ICSC # 0015 UN # 1114 EC # 601-020-00-8					
TYPES OF HAZARD/ EXPOSUREACUTE HAZARDS/ SYMPTOMS		PREVENTION		FIRST AID/ FIRE FIGHTING	
FIRE	Highly flammable.		NO open flames, NO sparks, and NO smoking.		Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive. Risk of fire and explosion: see chemical dangers.		Closed system, ventilation, explosion-proof electrical equipment and lighting. Do NOT use compressed air for filling, discharging, or handling. Use non-sparking handtools.		In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE	RE		AVOID ALL CONTACT!		
• INHALATION	Dizziness. Drowsiness. Headache. Nausea. Shortness of breath. Convulsions. Unconsciousness.		Ventilation, local exhaust, or breathing protection.		Fresh air, rest. Refer for medical attention.
• SKIN	MAY BE ABSORBED! Dry skin (further see Inhalation).		Protective gloves. Protective clothing.		Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
• EYES			face shield, or eye protection in combination with breathing protection.		First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION	Abdominal pain. Sore throat. Vomiting (further see Inhalation).		Do not eat, drink, or smoke during work.		Rinse mouth. Do NOT induce vomiting. Refer for medical attention.
SPILLAGE DISPOSAL ST		STORAGE PACKAGING & LABELLING		PACKAGING & LABELLING	
Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer		Fireproof. Se feedstuffs, or	ireproof. Separated from food and cedstuffs, oxidants and halogens. F sym T sym R: 45-		t transport with food and uffs. bol bol .11-48/23/24/25

(extra personal protection: complete S: 53-45 protective clothing including self-UN Hazard Class: 3 contained breathing apparatus). UN Packing Group: II

#### SEE IMPORTANT INFORMATION ON BACK

**ICSC: 0015** 

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities @ IPCS CEC 1993

## **International Chemical Safety Cards**

## **BENZENE**

**ICSC: 0015** 

I M P O R T A N T D A T A	<ul> <li>PHYSICAL STATE; APPEARANCE: COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.</li> <li>PHYSICAL DANGERS: The vapour is heavier than air and may travel along the ground; distant ignition possible.</li> <li>CHEMICAL DANGERS: Reacts violently with oxidants and halogens causing fire and explosion hazard.</li> <li>OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV: 10 ppm; 32 mg/m<sup>3</sup> (as TWA) A2 (ACGIH 1991-1992).</li> </ul>	<ul> <li>ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation and through the skin.</li> <li>INHALATION RISK: A harmful contamination of the air can be reached rather quickly on evaporation of this substance at 20°C; on spraying or dispersion, however, much faster.</li> <li>EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the skin and the respiratory tract. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the central nervous system. Exposure far above the occupational exposure limit may result in unconsciousness.</li> <li>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: The liquid defats the skin. The substance may have effects on the blood forming organs, liver and immune system. This substance is carcinogenic to humans</li> </ul>			
PHYSICAL PROPERTIES	Boiling point: 80°C Melting point: 6°C Relative density (water = 1): 0.9 Solubility in water, g/100 ml at 25°C: 0.18 Vapour pressure, kPa at 20°C: 10 Relative vapour density (air = 1): 2.7	Relative density of the vapour/air-mixture at 20°C (air = 1): 1.2 Flash point: -11°C (c.c.)°C Auto-ignition temperature: about 500°C Explosive limits, vol% in air: 1.2-8.0 Octanol/water partition coefficient as log Pow: 2.13			
ENVIRONMENTAL DATA					
NOTES					
Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is indicated. The odour warning when the exposure limit value is exceeded is insufficient. Transport Emergency Card: TEC (R)-7 NFPA Code: H2; F3; R0;					
ADDITIONAL INFORMATION					

ICSC: 0015	BENZENE
	© IPCS, CEC, 1993
IMPORTANT LEGAL NOTICE:	Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.

#### JACE OIL CO -- REGULAR DIESEL (FUEL OIL #2) -- 9140-00-247-4362

Product ID:REGULAR DIESEL (FUEL OIL #2) MSDS Date:01/01/1987 FSC:9140 NIIN:00-247-4362 MSDS Number: BKQTP === Responsible Party === Company Name: JACE OIL CO Address:180 E OCEAN BLD, SUIT 902 City:LONG BEACH State:CA ZIP:90802 Country:US Info Phone Num: 213-495-3342, 800-447-7902 Emergency Phone Num: 213-495-3342, 800-447-7902 CAGE:0KB31 === Contractor Identification === Company Name: JACE OIL CO Address:180 E OCEAN BLVD SUITE 902 Box:City:LONG BEACH State:CA ZIP:90802 Country:US Phone: 213-495-3342 CAGE:0KB31 Ingred Name: PETROLEUM DISTILLATE MIXTURE Fraction by Wt: 100% Other REC Limits: NONE SPECIFIED OSHA PEL:400 PPM ACGIH TLV:300 PPM LD50 LC50 Mixture:ORAL LD50 (RAT) 9ML/KG Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO Health Hazards Acute and Chronic: ACUTE-INGESTION: HARMFUL OR FATAL. ASPIRATION INTO LUNGS CAN CAUSE CHEMICAL PNEUMONIA AND CAN BE FATAL. INHALATION OF MIST MAY CAUAE IRRITATION OF NOSE & THROAT. EYE: IRRITATION. SKIN: IRRITATION. CHR ONIC-PROLONGED/REPEATED SKIN CONTACT MAY CAUSE IRRITATION, DERMATITIS. Effects of Overexposure: INHALATION MAY CAUSE IRRITATION OF NOSE, THROAT AND DIZZINESS. PROLONGED OR REPEATED SKIN CONTACT MAY CAUSE SKIN IRRITATION. EYE CONTACT MAY CAUSE EYE IRRITATION.INGESTION: VOMITING, WEEKNESS, COMA, CO NVUSIONS. Medical Cond Aggravated by Exposure: PERSONS WITH SKIN & PULMONARY DISORDERS SHOULD AVOID PROLONGED CONTACT WHEN HANDLING OR USING THIS PRODUCT. First Aid:SKIN: REMOVE CONTAMINATED CLOTHING. WASH WITH SOAP AND WATER.

GET MEDICAL ATTENTION IF IRRITATION PERSISTS. INHALATION: REMOVE TO

FRESH AIR & RESTORE BREATHING IF NECESSARY. GET MEDICAL ATTENTION. EYE : IMMEDIATELY FLUSH WITH WATER FOR 15 MINUTES WHILE HOLDING EYELIDS OPEN. GET MEDICAL ATTENTION. INGESTION: GET IMMEDIATE MEDICAL ATTENTION. DO NOT INDUCE VOMITING. NOTHING BY MOUTH IF UNCONSCIOUS.

Flash Point Method:PMCC
Flash Point:140F,60C
Autoignition Temp:Autoignition Temp Text:500F
Lower Limits:0.3
Upper Limits:10.0
Extinguishing Media:USE HALON, CARBON DIOXIDE, FOAM, OR DRY CHEMICAL.
Fire Fighting Procedures:WEAR FIRE FIGHTING PROTECTIVE EQUIPMENT AND A
 FULL FACED SELF CONTAINED BREATHING APPARATUS. COOL FIRE EXPOSED
 CONTAINERS WITH WATER SPRAY. CONTAIN RUNOFF.
Unusual Fire/Explosion Hazard:COMBUSTION OR HEAT OF FIRE MAY PRODUCE

Unusual Fire/Explosion Hazard:COMBUSTION OR HEAT OF FIRE MAY PRODUCE HAZARDOUS DECOMPOSITION PRODUCTS AND VAPORS.

Spill Release Procedures:RECOVER FREE PRODUCT, OR ABSORB WITH DIATOMACEOUS EARTH OR OTHER INERT MATERIAL. STORE IN APPROPRIATE CONTAINER FOR DISPOSAL. KEEP PRODUCT OUT OF SEWERS AND WATERCOURSES BY DIKING OR IMPOUNDING. MINIM IZE SKIN CONTACT AND BREATHING VAPORS.

Handling and Storage Precautions:AVOID STORAGE NEAR OPEN FLAME OR OTHER SOURCES OF IGNITION, AND STRONG OXIDANTS. KEEP CONTAINERS CLOSED.
Other Precautions:EMPTY CONTAINERS RETAIN RESIDUE. DO NOT PRESSURIZE, CUT, WELD OR EXPOSE TO HEAT, FLAME, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY.

======== Exposure Controls/Personal Protection ==========

Respiratory Protection:USE SUPPLIED-AIR RESPIRATORY PROTECTION IN CONFINED OR ENCLOSED SPACES, IF NEEDED.

Ventilation:SUFFICIENT TO MAINTAIN ATMOSPHERE BELOW TLV LIMIT.

Protective Gloves:NEOPRENE, NITRILE, OR POLYVINYL ALCOHOL

Eye Protection: USE CHEMICAL SAFETY GOGGLES

Other Protective Equipment: EYE WASH STATION & SAFETY SHOWER. CHEMICALLY RESISTANT BOOTS AND APRONS RECOMMENDED.

Work Hygienic Practices:DO NOT TAKE INTERNALLY. AVOID SKIN/EYE CONTACT. WASH SKIN AFTER USING PRODUCT. DO NOT EAT, DRINK OR SMOKE IN WORK AREA.

Supplemental Safety and Health

WASH OR TAKE SHOWER IF GENERAL CONTACT OCCURS. REMOVE OIL-SOAKED CLOTHING AND LAUNDER BEFORE REUSE. DISCARD CONTAMINATED LEATHER GLOVES AND SHOES.

HCC:F4 Boiling Pt:B.P. Text:350F,177C Vapor Pres:0.4 Vapor Density:>3.0 Spec Gravity:0.81-0.85 Disclaimer (provided with this information by the compiling agencies): This information is formulated for use by elements of the Department of Defense. The United States of America in no manner whatsoever, expressly or implied, warrants this information to be accurate and disclaims all liability for its use. Any person utilizing this document should seek competent professional advice to verify and assume responsibility for the suitability of this information to their particular situation.





## Diesel exhaust

#### Synonyms & Trade Names

CAS No.

RTECS No. HZ1755000

DOT ID & Guide

Formula

Conversion

IDLH Ca [N.D.] See: IDLH INDEX

Exposure Limits NIOSH REL Ca See Appendix A (nengapdxa.html) OSHA PEL none

Measurement Methods NIOSH 5040 , <u>2560</u> See: NMAM or OSHA Methods

Physical Description Appearance and odor vary depending upon the specific diesel exhaust component.

Molecular Weight Properties vary depending upon the specific component diesel exhaust component.

Incompatibilities & Reactivities Varies

Exposure Routes inhalation, skin and/or eye contact

Symptoms Eye irritation, pulmonary function changes; [potential occupational carcinogen]

Target Organs Eyes, respiratory system

Cancer Site [in animals: lung tumors]

Personal Protection/Sanitation (See protection codes (protect.html)) Skin:No recommendation Eyes:No recommendation Wash skin:No recommendation Remove:No recommendation Change:No recommendation

First Aid (See procedures (firstaid.html))

Breathing:Respiratory support

#### **Respirator Recommendations**

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

#### Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter. <u>Click here (pgintrod.html#nrp)</u> for information on selection of N, R, or P filters. Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also INTRODUCTION

File Formats Help:

How do I view different file formats (PDF, DOC, PPT, MPEG) on this site?

(//www.cdc.gov/Other/plugins/)

(//www.cdc.gov/Other/plugins/#pdf)

Page last reviewed: April 11, 2016

Page last updated: April 11, 2016

Content source: National Institute for Occupational Safety and Health (NIOSH) (/niosh/) Education and Information Division

## **International Chemical Safety Cards**

## ETHYLBENZENE

ICSC: 0268

ETHYLBENZENEEthylbenzol Phenylethane EB C_8H_{10}/C_6H_5-C_2H_5 Molecular mass: 106.2 CAS # 100-41-4 RTECS # DA0700000 ICSC # 0268 UN # 1175 EC # 601-023-00-4					
TYPES OF HAZARD/ EXPOSUREACUTE HAZARDS/ SYMPTOMS		PREVENTION		FIRST AID/ FIRE FIGHTING	
FIRE	Highly flammable.		NO open flames, NO sparks, and NO smoking.		Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.		Closed system, ventilation, explosion-proof electrical equipment and lighting. Do NOT use compressed air for filling, discharging, or handling.		In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE			PREVENT GENERATION OF MISTS!		
• INHALATION	Cough. Dizziness. Drowsiness. Headache.		Ventilation, local exhaust, or breathing protection.		Fresh air, rest. Refer for medical attention.
• SKIN	Dry skin. Redness.		Protective gloves.		Remove contaminated clothes. Rinse and then wash skin with water and soap.
• EYES	Redness. Pain. Blurred vision.		Face shield or eye protection in combination with breathing protection.		First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION	(further see Inhalat	ion).	Do not eat, drink, or smoke during work.		Rinse mouth. Give a slurry of activated charcoal in water to drink. Refer for medical attention.
SPILLAGE DISPOSAL			STORAGE		PACKAGING & LABELLING
Ventilation. Collect leaking liquid in covered containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer (extra personal		Fireproof. Separated from strong oxidants.		F sym Xn sy R: 11- S: (2-)	bol mbol 20 )16-24/25-29

protection: A filter respirator for organic vapour).

UN Hazard Class: 3 UN Packing Group: II

SEE IMPORTANT INFORMATION ON BACK

**ICSC: 0268** 

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993

## **International Chemical Safety Cards**

## **ETHYLBENZENE**

#### **ICSC: 0268**

I M	PHYSICAL STATE; APPEARANCE: COLOURLESS LIQUID , WITH AROMATIC ODOUR.	<b>ROUTES OF EXPOSURE:</b> The substance can be absorbed into the body by inhalation of its vapour, through the skin and by ingestion.			
Р	<b>PHYSICAL DANGERS:</b> The vapour mixes well with air explosive	INHALATION RISK			
0	mixtures are easily formed.	A harmful contamination of the air will be reached rather slowly on evaporation of this			
R	CHEMICAL DANGERS: Reacts with strong oxidants. Attacks plastic	substance at 20°C.			
Т		EXPOSURE:			
Α	OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV (as TWA): 100 mmu 424 ms/m <sup>3</sup> , as	The substance irritates the eyes, the skin and the respiratory tract. Swallowing the liquid may cause aspiration into the lungs with the			
Ν	STEL: 125 ppm; 543 mg/m <sup>3</sup> (ACGIH 1994-	risk of chemical pneumonitis. The substance			
Т	1995). MAK: 100 ppm; 440 mg/m <sup>3</sup> (1994).	system. Exposure far above OEL could cause lowering of consciousness.			
D		EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Repeated or prolonged contact with skin may			
Α		cause dermatitis.			
Т					
Α					
PHYSICAL PROPERTIES	Boiling point: 136°C Melting point: -95°C Relative density (water = 1): 0.9 Solubility in water, g/100 ml at 20°C: 0.015 Vapour pressure, kPa at 20°C: 0.9 Relative vapour density (air = 1): 3.7	Relative density of the vapour/air-mixture at 20°C (air = 1): 1.02 Flash point: 18°C c.c. Auto-ignition temperature: 432°C Explosive limits, vol% in air: 1.0-6.7 Octanol/water partition coefficient as log Pow: 3.2			
ENVIRONMENTAL DATA	The substance is harmful to aquatic organisms.				
N O T E S					
The odour warning when the exposure limit value is exceeded is insufficient. Transport Emergency Card: TEC (R)-522 NFPA Code: H2; F3; R0					
ADDITIONAL INFORMATION					

1
ICSC: 0268		ETHYLBENZENE
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#### BELCHER COMPANY -- REGULAR GASOLINE -- 9130-00B020054

Product ID:REGULAR GASOLINE MSDS Date:10/01/1985 FSC:9130 NIIN:00B020054 MSDS Number: BHHFG === Responsible Party === Company Name: BELCHER COMPANY Address:9 GREENWAY PLACE City:HOUSTON State:TX ZIP:77046 Country:US Info Phone Num:713-877-1400 Emergency Phone Num: 713-877-1400 Preparer's Name: DELNO MALZAHN, CIH CAGE:00033 === Contractor Identification === Company Name: BELCHER COMPANY Address:9 GREENWAY PLAZA City:HOUSTON State: TX ZIP:77046 Country:US Phone: 713-877-1400 CAGE:00033 Ingred Name: GASOLINE CAS:8006-61-9 RTECS #:LX3300000 Fraction by Wt: 90-95% OSHA PEL:300 PPM/500 STEL ACGIH TLV:300 PPM/500STEL;9192 Ingred Name:BENZENE (SARA III) CAS:71-43-2 RTECS #:CY1400000 Fraction by Wt: 0.5-4.9% OSHA PEL:1PPM/5STEL;1910.1028 ACGIH TLV:10 PPM; A2; 9192 EPA Rpt Qty:10 LBS DOT Rpt Qty:10 LBS Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO Health Hazards Acute and Chronic:SKIN-RECENT STUDIES INDICATE KIDNEY DAMAGE AND KIDNEY CANCER IN RATS AND LIVER CANCER IN MICE. Effects of Overexposure: MODERATELY IRRITATING TO SKIN. CAUSES REDNESS AND DRYING OF SKIN. IRRITATING TO MUCOUS MEMBRANES AND RESPIRATORY TRACT. WILL PRODUCE SYMPTOMS OF INTOXICATION. CAN ACT AS A SIMPLE ASPHYXIANT. INGESTION MAY CAUSE MILD EXCITATION, LOSS OF CONSCIOUSNESS, CONVULSIONS, CYANOSIS, CONGESTION AND CAPILLARY

HEMORRHAGING OF LUNGS/ORGA Medical Cond Aggravated by Exposure: MAY AGGRAVATE PRE-EXISTING DERMATITIS. First Aid: FLUSH EYES WITH WATER FOR 15 MIN.GET MEDICAL ATTENTION.FOR SKIN, REMOVE CONTAMINATED CLOTHING WASH WITH SOAP & WATER. IF INHALED, MOVE TO FRESH AIR. APPLY ARTIFICIAL RESPIRATION IF NOT BREATHING. GET ME DICAL ATTENTION. IF INGESTED, DO NOT INDUCE VOMITING. IF SPONTANEOUS VOMITING OCCURS, HOLD VICTIM'S HEAD LOWER THAN HIPS TO PREVENT ASPIRATION. Flash Point:-45 Lower Limits:1.4 Upper Limits:7.6 Extinguishing Media: DRY CHEMICAL, FOAM, CARBON DIOXIDE. Fire Fighting Procedures: FIREFIGHTERS SHOULD WEAR SELF-CONTAINED BREATHING APPARATUS.WATER MAY BE INEFFECTIVE ON FLAMES, BUT SHOULD BE USED TO KEEP FIRE-EXPOSED CONTAINERS COOL. Unusual Fire/Explosion Hazard: CAN BE IGNITED BY SELF-GENERATED STATIC ELECTRICITY; CONTAINERS SHOULD BE BONDED AND GROUNDED. Spill Release Procedures: REMOVE SOURCES OF HEAT OR IGNITION, INCLUDING INTERNAL COMBUSTION ENGINES AND ROWER TOOLS.CLEAN-UP SPILL BUT DO NOT FLUSH TO SEWER OR SURFACE WATER. VENTILATE AREA AND AVOID BREATHING VAPORS OR MISTS. Handling and Storage Precautions:STORE IN TIGHTLY CLOSED CONTAINERS IN A COOL, DRY PLACE, AWAY FROM SOURCES OF HEAT OR IGNITION. GROUND AND BOND ALL TRANSFER & STORAGE EQUIP WITH SELF CL Other Precautions: CONTACT BELCHER COMPANY FOR FURTHER INFORMATION. Respiratory Protection: USE APPROVED RESPIRATORY PROTECTIVE EQUIPMENT FOR CLEANING LARGE SPILLS OR ENTRY INTO LARGE TANKS, VESSELS OR OTHER CONFINED SPACES. Ventilation: PROVIDE ADEQUATE VENTILATION TO KEEP MIST OR VAPORS BELOW ALLOWABLE EXPOSURE LEVELS. Protective Gloves: IMPERVIOUS. Eye Protection: CHEMICAL SAFETY GLASSES OR GOGGLES. Supplemental Safety and Health Boiling Pt:B.P. Text:80-430 Melt/Freeze Pt:M.P/F.P Text:VARIABLE Vapor Pres: 325-525 Vapor Density: 3-4 AIR=1 Spec Gravity:0.7-0.77 Solubility in Water:NEGLIGIBLE Appearance and Odor: BRONZE FLUID, AROMATIC ODOR. Percent Volatiles by Volume:100

6/7/2010

Waste Disposal Methods:DISPOSE THROUGH A LICENSED WASTE DISPOSAL COMPANY. FOLLOW FEDERAL,STATE AND LOCAL REGULATIONS.

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#### GEORGIA GULF CORP -- HYDROCHLORIC ACID -- 6810-00F030501

Product ID:HYDROCHLORIC ACID MSDS Date:02/01/1992 FSC:6810 NIIN:00F030501 MSDS Number: BSLCY === Responsible Party === Company Name: GEORGIA GULF CORP Address:400 PERIMETER CENTER TER SUITE 595 Box:105197 City:ATLANTA State:GA ZIP:30348 Country:US Info Phone Num: 504-685-1200/404-395-4500 Emergency Phone Num: 504-685-2638/404-395-4500 CAGE:49960 === Contractor Identification === Company Name: GEORGIA GULF CORPORATION Address:400 PERIMETER CENTER TER SUITE 595 Box:105197 City:ATLANTA State:GA ZIP:30348 Country:US Phone: 504-685-2500/770-395-4500 GOOD# CAGE:49960 Ingred Name: HYDROCHLORIC ACID, HYDROGEN CHLORIDE, MURIATIC ACID HYDROCHLORIDE CAS:7647-01-0 RTECS #:MW4025000 Fraction by Wt: 30.5% Other REC Limits:7 PPM OSHA PEL:5 PPM ACGIH TLV:C 11 MG/CUM EPA Rpt Qty:5000 LBS DOT Rpt Qty:5000 LBS LD50 LC50 Mixture:ORAL LDLO (HUMAN): 81 MG/KG Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO Health Hazards Acute and Chronic:CORROSIVE TO SKIN, EYES, NOSE MUCOUS MEMBRANES, RESPIRATORY & GASTROINTESTINAL TRACT. INHALATION: RESPIRATORY TRACT IRRITATION/INFECTION. SEVERE & FATAL GASTROINTESTINAL BURNS W/NECROSIS. SEVERE BURNS TO EYES & BLINDNESS. CHANGES IN PULMONARY FUNCTION, CHRONIC BRONCHITIS, DERMATITIS, TOOTH EROSION, & CONJUNCTIVITIS. Explanation of Carcinogenicity:NONE Effects of Overexposure: INHALATION: BURNING, CHOKING, COUGHING & SEVERE BREATHING DIFFICULTIES. INGESTION: PAIN IN MOUTH, THROAT & STOMACH. SKIN: INFLAMMATION & SCARRING, RASH. EYES: BURNS.

Medical Cond Aggravated by Exposure:SKIN, RESPIRATORY OR DIGESTIVE DISEASE

First Aid:INHALATION: REMOVE TO FRESH AIR. IF BREATHING STOPS, GIVE
ARTIFICIAL RESPIRATION. PROVIDE EMERGENCY AIRWAY SUPPORT, IF
INDICATED, GIVING 100% HUMIDIFIED SUPPLEMENTAL OXYGEN. SKIN: WASH
W/SOAP & PLENTY OF WATER PROMPTLY. REMOVE CLOTHING. EYES:
IMMEDIATELY FLUSH W/PLENTY OF ROOM TEMPERATURE WATER FOR AT LEAST
15 MINS, OCCASIONALLY LIFTING LOWER/UPPER LIDS. INGESTION: DON'T
INDUCE VOMITING. SEE SUPP.

- Extinguishing Media: FLOODING AMOUNTS OF WATER, DRY CHEMICAL, ALCOHOL FOAM
- Fire Fighting Procedures: KEEP UNNECESSARY PEOPLE AWAY. ISOLATE HAZARD AREA & DENY ENTRY. STAY UPWIND. USE ACID PROOF FULL PROTECTIVE CLOTHING & NIOSH APPROVED SELF-CONTAINED RESPIRATOR.
- Unusual Fire/Explosion Hazard:HYDROCHLORIC ACID DOES NOT IGNITE READILY. ADDING WATER TO HYDROCHLORIC ACID PRODUCES VIOLENT EXOTHERMIC REACTION.

- Spill Release Procedures:RESTICT ACCESS TO AREA. MOVE UNPROTECTED PERSONNEL UPWIND. WEAR APPROPRIATE CLOTHING & RESPIRATORY EQUIPMENT. DON'T TOUCH SPILL. PREVENT SPILLS FROM ENTERING WATER WAYS & SEWERS. NEUTRALIZE & PLACE IN TO CONTAINERS FOR PROPER DISPOSAL.
- Neutralizing Agent: BASE SUCH AS LIME, SODIUM HYDROXIDE

Handling and Storage Precautions:STORE IN COOL, DRY, WELL VENTILATED PLACE. STORE AWAY FROM OXIDIZING AGENTS & ALKALINE MATERIALS.

======== Exposure Controls/Personal Protection ==========

- Respiratory Protection:USE NIOSH APPROVED RESPIRATOR. RESPIRATORS MUST BE SELECTED BASED ON AIRBORNE LEVELS FOUND IN THE WORKPLACE & MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR.
- Ventilation:LOCAL TO MAINTAIN EXPOSURE LEVELS BELOW RECOMMENDED EXPOSURE LIMITS
- Protective Gloves:NEOPRENE/POLYVINYL CHLORIDE/BUTYL RUBBER
- Eye Protection: SPLASH PROOF CHEMICAL SAFETY GOGGLES
- Other Protective Equipment:QUICK DRENCH, IMPERVIOUS CLOTHING, EYE WASH FOUNTAIN
- Work Hygienic Practices:REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.
- Supplemental Safety and Health
- FIRST AID: DON'T GIVE SODIUM BICARBONATE IN AN ATTEMPT TO NEUTRALIZE THE ACID. THIS CAN RESULT IN AN EXOTHERMIC REACTION & WORSEN THE BURN. IMMEDIATE DILUTION W/WATER OR MILK MAY BE BENEFICIAL. OBTAIN MEDICAL ATTENTION IN ALL CASES.

Boiling Pt:B.P. Text:81.5C

Melt/Freeze Pt:M.P/F.P Text:-114.8C Vapor Pres:25 Vapor Density:1.27 Spec Gravity:1.16 pH:<1 Solubility in Water:COMPLETE Appearance and Odor: WHITE TO YELLOW, CLEAR LIQUID W/STRONG IRRITATING ODOR Stability Indicator/Materials to Avoid:YES ALKALINE MATERIALS & OXIDIZING AGENTS. HIGHLY CORROSIVE TO MOST METALS. Hazardous Decomposition Products: REACTS W/METALS TO FORM FLAMMABLE HYDROGEN GAS Waste Disposal Methods: DISPOSE OF IN ACCORDANCE W/LOCAL, STATE, & FEDERAL REGULATIONS. CORROSIVE, UN1789.

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#### HNU SYSTEMS INC -- ISOBUTYLENE SPAN GAS, SEE SUPP DATA -- 6665-01-214-8247

Product ID: ISOBUTYLENE SPAN GAS, SEE SUPP DATA MSDS Date: 12/08/1987 FSC:6665 NIIN:01-214-8247 MSDS Number: BJDVR === Responsible Party === Company Name: HNU SYSTEMS INC Address:160 CHARLEMONT ST City:NEWTON HIGHLANDS State:MA ZIP:02161 Country:US Info Phone Num: 617/964-6690 Emergency Phone Num: 800/841-4357 CAGE: 57631 === Contractor Identification === Company Name: HNU SYSTEMS INC Address:160 CHARLEMONT ST Box:City:NEWTON HIGHLANDS State:MA ZIP:02161 Country:US Phone: 617/964-6690 CAGE: 57631 Ingred Name: ISOBUTYLENE CAS:115-11-7 RTECS #:UD0890000 Fraction by Wt: 0.01% LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER. Routes of Entry: Inhalation:YES Skin:NO Ingestion:NO Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO Health Hazards Acute and Chronic: ISOBUTYLENE IS A SIMPLE ASPHYXIANT; MODERATE CONCENTRATION IN AIR CAUSE UNCONSCIOUSNESS. CONTACT W/LIQUID CAUSES FROSTBITE. Explanation of Carcinogenicity:NOT RELEVANT Effects of Overexposure:SEE HEALTH HAZARDS. Medical Cond Aggravated by Exposure: NONE SPECIFIED BY MANUFACTURER. First Aid: IF BREATHED, REMOVE INDIVIDUAL TO FRESH AIR. IF BREATHING IS DIFFICULT, ADMINISTER OXYGEN. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. KEEP PERSON WARM, QUIET; GET MEDICAL ATTENTION. Flash Point Method:CC Flash Point:-76 C OR -105 F

Lower Limits:1.8% Upper Limits:9.6% Extinguishing Media:CO2 OR DRY CHEMICAL Fire Fighting Procedures: STOP FLOW OF ISOBUTYLENE IF POSSIBLE. USE WATER SPRAY TO COOL SURROUNDING CONTAINERS. Unusual Fire/Explosion Hazard: ISOBUTYLENE IS HEAVIER THAN AIR MAY TRAVEL CONSIDERABLE DISTANCE TO SOURCE OF IGNITION. SHOULD FLAME BE EXTINGUISHED AND FLOW OF GAS CONTINUE SEE SUPP DATA. Spill Release Procedures: NONE SPECIFIED BY MANUFACTURER. Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER. Handling and Storage Precautions:STORE AWAY FROM HEAT AND PROTECT CYLINDERS FROM PHYSICAL DAMAGE. Other Precautions: DO NOT PUNCTURE CYLINDER. ======= Exposure Controls/Personal Protection ========== Respiratory Protection: POSITIVE PRESSURE AIR LINE OR SCBA FOR EMERGENCY USE. Ventilation: HOOD W/FORCED VENTILATION TO PREVENT ACCUMULATION ABOVE LET. Protective Gloves: PLASTIC OR RUBBER. Eye Protection: SAFETY GOGGLES OR GLASSES. Other Protective Equipment: SAFETY SHOES, SAFETY SHOWER, EYEWASH FOUNTAIN. Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER. Supplemental Safety and Health MFR PART NO, TRADE NAME: CALIBRATION GAS 101- 350-N, DC102573.EXPLO HAZ: INCREASE VENTILATION TO PREVENT FORMATION OF FLAMMABLE MIXTURE IN LOW AREAS/POCKETS. NOTE: DATA GIVEN FOR PURE ISOBUTLENE. CYLINDE R OF HNU SPAN GAS/ISOBUTYLENE CALIBRATION GAS CONTAINS 100 PPM IN ZERO AIR OR 0.01% ISOBUTYLENE IN AIR. Boiling Pt:B.P. Text:19.6F,-6.9C Melt/Freeze Pt:M.P/F.P Text:-221F,-140C Vapor Pres:@20C 24SIG Vapor Density:1.95 Spec Gravity:0.59 Solubility in Water:UNAVAILABLE Appearance and Odor: CLEAR UNPLEASANT ODOR SIMILAR TO COAL GAS Stability Indicator/Materials to Avoid:YES OXIDIZERS. Stability Condition to Avoid: NONE SPECIFIED BY MANUFACTURER. Hazardous Decomposition Products:NONE Waste Disposal Methods: DISPOSAL MUST BE I/A/W FED, STATE AND LOCAL REGULATIONS.

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FOR PRODUCT AND SALES INFORMATION

CONTACT ELECTRON MICROSCOPY SCIENCES OFFICE ABOVE.

PRODUCT IDENTIFICATION

PRODUCT NAME: Methanol

TRADE NAME: Methyl Alcohol, Wood Alcohol

CAS NUMBER: 67-56-1

CHEMICAL FAMILY: Aliphatic Alcohol

FORMULA: CH3OH

MOLECULAR WEIGHT: 32.04

DOT SHIPPING NAME: Methanol

DOT NUMBER: UN1230

\* \* \* CATALOG NO: 18510 \* \* \* (Page 2 of 5)

```
NFPA HAZARD RATINGS: HEALTH: 1
REACTIVITY: 0
FLAMMABILITY: 3
SPECIAL HAZARDS: -
```

http://hazard.com/msds/mf/ems/files/18510.html

HAZARDOUS INGREDIENTS

None other than specified product.

PHYSICAL DATA

BOILING POINT (760 mm Hg): 64.5oC MELTING POINT: -98oC SPECIFIC GRAVITY (H2O=1): 0.791 VAPOR PRESSURE (mm Hg): 97 @ 20oC PERCENT VOLATILE BY VOL (%): 99.9+ VAPOR DENSITY (AIR=1): 1.1 EVAPORATION RATE (BUAC=1): 5.91 SOLUBILITY IN WATER (%): Miscible APPEARANCE AND ODOR: Colorless liquid, characteristic alcoholic odor.

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT: 520F (TCC)

FLAMMABLE LIMITS LEL %: 6.7 FLAMMABLE LIMITS UEL %: 36.5

EXTINGUISHING MEDIA: Dry chemical, "alcohol" foam, CO2, water mist.

FIRE FIGHTING PROCEDURE: Wear self-contained breathing apparatus.

FIRE & EXPLOSIVE HAZARDS:

Closed containers may explode upon heating. Vapor can travel distances to ignition source and flash back.

HEALTH HAZARD DATA (ACUTE AND CHRONIC)

ACGIH TLV/OSHA PEL (TWA):

(TLV) 200 ppm; STEL: 250 ppm (SKIN) (PEL) 200 ppm; STEL: 250 ppm (SKIN) \* \* \* CATALOG NO: 18510 \* \* \* (Page 3 of 5)

TOXICITY DATA:

ORL-HMN LDLO: 143 mg/kg ORL-RAT LD50: 5628 mg/kg IHL-RAT LD50: 64000 ppm/4 h ROUTES OF ENTRY: Inhalation, ingestion or skin contact. SYMPTOMS OF EXPOSURE:

Toxic by ingestion and inhalation. Can be toxic by skin

absorption.

Affects central nervous system, especially optic nerve.

Marked impairment of vision and enlargement of the liver has been reported with chronic exposure.

Causes dizziness, nausea, muscle weakness, narcosis, respiratory failure.

Ingestion can produce blindness (100 ml can be fatal).

Prolonged or repeated skin contact may cause irritation.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:

Skin conditions, eye problems, or impaired liver or kidney function.

CARCINOGENICITY: The material is not listed as a cancer causing agent.

EMERGENCY FIRST AID: Get medical assistance for all cases of overexposure.

SKIN: Wash thoroughly with soap and water.

EYES: Immediately flush thoroughly with large amounts of water.

INHALATION: Remove to fresh air; give artificial respiration if breathing has stopped.

INGESTION: Get immediate medical attention. If medical attention is not immediately available, induce vomiting. Do not induce vomiting if patient is unconscious.

Remove contaminated clothing and wash before reuse.

\* \* \* CATALOG NO: 18510 \* \* \* (Page 4 of 5)

#### REACTIVITY DATA

STABILITY: Yes

CONDITIONS TO AVOID: Heat; contact with ignition source.

MATERIALS TO AVOID: Oxidizers; reactive metals.

HAZARDOUS POLYMERIZATION: Does not occur

HAZARDOUS DECOMPOSITION: COX, Formaldehyde.

ENVIRONMENTAL PROTECTION PROCEDURES

SPILL RESPONSE: Dike spill; take up with absorbent; containerize for proper disposal

WASTE DISPOSAL: To be performed in compliance with all current local, State and Federal regulations.

#### SPECIAL PROTECTION INFORMATION

VENTILATION, RESPIRATORY PROTECTION, PROTECTIVE CLOTHING, EYE PROTECTION:

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves (butyl rubber, viton, or equivalent) should be worn to prevent skin contact.

Safety glasses with side shields should be worn at all times.

NIOSH/MSHA-approved respirator should be worn in the absence of adequate ventilation.

#### SPECIAL PRECAUTIONS

HANDLING AND STORAGE:

Store in a cool area away from ignition sources and oxidizers.

Do not breath vapor or solution mist. \* \* \* CATALOG NO: 18510 \* \* \* (Page 5 of 5)

Do not get in eyes, on skin, or on clothing.

Electrically ground all equipment when handling this product.

WORK/HYGIENIC PRACTICES:

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

#### OTHER INFORMATION

COMMENTS: Tests on laboratory animals indicate material may produce adverse mutagenic and reproductive effects.

# ULTRA SCIENTIFIC -- US-116 POLYNUCLEAR AROMATIC HYDROCARBONS MIXTURE -- 6810-00F037641

Product ID:US-116 POLYNUCLEAR AROMATIC HYDROCARBONS MIXTURE MSDS Date:08/15/1994 FSC:6810 NIIN:00F037641 MSDS Number: BWJNN === Responsible Party === Company Name:ULTRA SCIENTIFIC Address:250 SMITH STREET City:NORTH KINGSTOWN State:RI ZIP:02852-5000 Country:US Info Phone Num: 401-294-9400 Emergency Phone Num:401-294-9400 CAGE:0MU35 === Contractor Identification === Company Name:ULTRA SCIENTIFIC Address:250 SMITH STREET Box:City:NORTH KINGSTOWN State:RI ZIP:02852-5000 Country:US Phone: 401-294-9400 CAGE:0MU35 Ingred Name: BENZENE (SUSPECTED HUMAN CARC BY ACGIH, IARC, SUSPECTED ANIMAL CARC BY IARC, CARCINOGEN BY NTP - GROUP 1) \*94-4\* CAS:71-43-2 RTECS #:CY1400000 Fraction by Wt: 49.82% Other REC Limits:16 MG/CUM ACGIH TLV:0.3 MG/CUM (A2) IC EPA Rpt Qty:10 LBS DOT Rpt Qty:10 LBS Ingred Name: 7, 12-DIMETHYLBENZ A! ANTHRACENE CAS:57-97-6 RTECS #:CW3850000 Fraction by Wt: 0.182% Ingred Name: 3-METHYLCHOLANTHRENE CAS:56-49-5 RTECS #:FZ3675000 Fraction by Wt: 0.182% Ingred Name: DICHLOROMETHANE (METHYLENE CHLORIDE) (SUSP HUMAN CARC BY ACGIH, SUSP ANIM CARC BY IARC; NTP - IARC GROUP 2B) \*94-4\* CAS:75-09-2 RTECS #:PA8050000 Fraction by Wt: 49.82% ACGIH TLV:174 MG/CUM (A2) EPA Rpt Qty:1000 LBS

DOT Rpt Qty:1000 LBS

LD50 LC50 Mixture:ORAL LD50 (RAT): 2136 MG/KG (SEE SUPP) Routes of Entry: Inhalation:YES Skin:NO Ingestion:NO Reports of Carcinogenicity:NTP:YES IARC:YES OSHA:NO Health Hazards Acute and Chronic:TOXIC, IRRITATION. Explanation of Carcinogenicity:SEE INGREDIENTS Effects of Overexposure:IRRITATION.

First Aid:EYES/SKIN: FLUSH W/COPIOUS AMOUNTS OF WATER. INHALATION: REMOVE TO FRESH AIR. GIVE OXYGEN, IF NEEDED. OBTAIN MEDICAL ATTENTION IN ALL CASES.

Extinguishing Media:CO2, DRY CHEMICAL POWDER, WATER SPRAY

Spill Release Procedures: A LEAKING BOTTLE MAY BE PLACED IN A PLASTIC BAG & NORMAL DISPOSAL PROCEDURES FOLLOWED. LIQUID SAMPLES MAY BE ABSORBED ON VERMICULITE/SAND.

Handling and Storage Precautions:USE APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT. KEEP TIGHTLY CLOSED & STORE IN A COOL, DRY PLACE. Other Precautions:THIS MATERIAL SHOULD ONLY BE USED BY THOSE PERSONS TRAINED IN THE SAFE HANDLING OF HAZARDOUS CHEMICALS.

====== Exposure Controls/Personal Protection ==========

Protective Gloves:REQUIRED

Eye Protection: CHEMICAL GOGGLES, FACESHIELD

- Other Protective Equipment:CHEMICAL RESISTANT CLOTHING, LAB COAT/RUBBER APRON.
- Supplemental Safety and Health

ORAL LD50 INFORMATION IS FOR METHYLENE CHLORIDE.

Appearance and Odor:LIQUID

Stability Indicator/Materials to Avoid:YES STRONG OXIDIZERS

Waste Disposal Methods:BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER. DISPOSE OF IAW/FEDERAL, STATE & LOCAL REGULATIONS.

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# **International Chemical Safety Cards**

# TOLUENE

**ICSC: 0078** 

TOLUENE Methylbenzene						
Toluol $C_6H_5CH_3/C_7H_8$ Molecular mass: 92.1						
CAS # 108-88-3 RTECS # XS5250000 ICSC # 0078 UN # 1294 EC # 601-021-00-3						
TYPES OF HAZARD/ EXPOSUREACUTE HAZARDS/ SYMPTOMSPREVENT				-	FIRST AID/ FIRE FIGHTING	
FIRE	Highly flammable.		NO open flames, NO sparks, and NO smoking.		Powder, AFFF, foam, carbon dioxide.	
EXPLOSION	Vapour/air mixtures are explosive.         Closed system, ventilation, explosion-proof electrical equipment and lighting. Prevent build-up of electrostatic charges (e.g., by grounding). Do NOT use compressed air for filling, discharging, or handling.		In case of fire: keep drums, etc., cool by spraying with water.			
EXPOSURE		STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN!				
• INHALATION	INHALATION Dizziness. Drowsiness. Headache. Nausea. Unconsciousness.		Ventilation, local exhaust, or breathing protection.		Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.	
• SKIN	Dry skin. Redness.		Protective gloves.		Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.	
• EYES	Redness. Pain.		Safety goggles or face shield.		First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.	
• INGESTION	Abdominal pain. B sensation (further s Inhalation).	urning Do not eat, drink, or smol ee during work.		te	Rinse mouth. Give a slurry of activated charcoal in water to drink. Do NOT induce vomiting. Refer for medical attention.	
SPILLAGE	SPILLAGE DISPOSAL		STORAGE		PACKAGING & LABELLING	

Collect leaking liquid in sealable	Fireproof. Separated from strong				
containers. Absorb remaining liquid in	oxidants.	F symbol			
sand or inert absorbent and remove to		Xn symbol			
safe place. Do NOT wash away into		R: 11-20			
sewer (extra personal protection: self-		S: (2-)16-25-29-33			
contained breathing apparatus).		UN Hazard Class: 3			
		UN Packing Group: II			
SEE IMPORTANT INFORMATION ON BACK					

**ICSC: 0078** 

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# **International Chemical Safety Cards**

# **TOLUENE**

# **ICSC: 0078**

I M	<b>PHYSICAL STATE; APPEARANCE:</b> COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR.	<b>ROUTES OF EXPOSURE:</b> The substance can be absorbed into the body by inhalation, through the skin and by
P	<b>PHYSICAL DANGERS:</b> The vapour is heavier than air and may travel	INHALATION RISK:
0	along the ground; distant ignition possible. As a result of flow, agitation, etc., electrostatic	A harmful contamination of the air can be reached rather quickly on evaporation of this
R	charges can be generated.	substance at 20°C.
Т	CHEMICAL DANGERS: Reacts violently with strong oxidants causing	EFFECTS OF SHORT-TERM EXPOSURE:
Α	OCCUPATIONAL EXPOSURE LIMITS	respiratory tract. Exposure could cause central
Ν	(OELs):	levels may result in cardiac dysrhythmia,
Т	TLV: 50 ppm; 188 mg/m <sup>3</sup> (as TWA) (skin) (ACGIH 1993-1994).	unconsciousness and death.
D		<b>EFFECTS OF LONG-TERM OR</b> <b>REPEATED EXPOSURE:</b> Repeated or prolonged contact with skin may cause dermatitie. The substance may have
Α		effects on the central nervous system, resulting in decreased learning ability and
Т		that this substance possibly causes toxic
Α		encers upon numan reproduction.
PHYSICAL PROPERTIES	Boiling point: 111°C Melting point: -95°C Relative density (water = 1): 0.87 Solubility in water: none Vapour pressure, kPa at 20°C: 2.9 Relative vapour density (air = 1): 3.2	Relative density of the vapour/air-mixture at 20°C (air = 1): 1.06 Flash point: 4°C c.c.°C Auto-ignition temperature: 480°C Explosive limits, vol% in air: 1.1-7.1 Octanol/water partition coefficient as log Pow: 2.69
ENVIRONMENTAL DATA		
	NOTES	

Depending on the degree of exposure, periodic medical examination is indicated.

Transport Emergency Card: TEC (R)-31
NFPA Code: $H 2; F 3; K 0;$

ADDITIONAL INFORMATION					
ICSC: 0078	TOLUENE				
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r					
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# **International Chemical Safety Cards**

# **m-XYLENE**

$\begin{array}{c} \begin{array}{c} \mbox{m-XYLENE} \\ \mbox{meta-Xylene} \\ 1,3-Dimethylbenzene \\ \mbox{m-Xylol} \\ C_6H_4(CH_3)_2/C_8H_{10} \\ \mbox{Molecular mass: } 106.2 \\ \mbox{CAS \# 108-38-3} \\ \mbox{RTECS \# ZE2275000} \\ \mbox{ICSC \# 0085} \\ \mbox{UN \# 1307} \\ \mbox{EC \# 601, 022, 00, 0} \end{array}$					
TYPES OF HAZARD/ EXPOSUREACUTE HAZARDS/ SYMPTOMSPREVENTIONFIRST AID/ FIRE FIGHTING					FIRST AID/ FIRE FIGHTING
FIRE	Flammable.		NO open flames, NO sparks,		Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Above 27°C explosive vapour/air mixtures may be formed.		Above 27°C use a closed system, ventilation, and explosion-proof electrical equipment.		In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE STRICT HYGIENE!					
• INHALATION	Dizziness. Drowsiness. Headache. Unconsciousness.		Ventilation, local exhaust, or breathing protection.		Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
• SKIN	Dry skin. Redness.		Protective gloves.		Remove contaminated clothes. Rinse and then wash skin with water and soap.
• EYES	Redness. Pain.		Safety spectacles.		First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION	Abdominal pain. B sensation (further s Inhalation).	Irning Do not eat, drink, or smoke during work.		e	Rinse mouth. Give a slurry of activated charcoal in water to drink. Do NOT induce vomiting. Refer for medical attention.
SPILLAGE DISPOSAL			STORAGE		PACKAGING & LABELLING
Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment.		Fireproof. S oxidants.	eparated from strong	Xn syn R: 10- S: (2-) Note: UN Ha	mbol 20/21-38 25 C azard Class: 3

## SEE IMPORTANT INFORMATION ON BACK

ICSC: 0085

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# **International Chemical Safety Cards**

# **m-XYLENE**

# ICSC: 0085

I M	PHYSICAL STATE; APPEARANC COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR.	<b>CE: ROUTES OF EXPOSURE:</b> The substance can be absorbed into the body by inhalation, through the skin and by ingestion.				
Р	<b>PHYSICAL DANGERS:</b> As a result of flow agitation etc. elec	etrostatic INHALATION RISK:				
0	charges can be generated.	A harmful contamination of the air will be reached rather slowly on evaporation of this				
R	Reacts violently with strong oxidants	substance at 20°C.				
Т	nitric acid.	EFFECTS OF SHORT-TERM EXPOSURE:				
Α	OCCUPATIONAL EXPOSURE LI (OELs):	MITS The substance irritates the eyes. Exposure far above the OEL may result in central nervous				
Ν	(ACGIH 1993-1994).	death.				
Т	TLV (as STEL): 150 ppm; 651 mg/m <sup>3</sup> (ACGIH 1993-1994).	EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:				
D		have effects on the central nervous system, resulting in decreased learning ability.				
Α						
Т						
Α						
PHYSICAL PROPERTIES	Boiling point: 139°C Melting point: -48°C Relative density (water = 1): 0.86 Solubility in water: none Vapour pressure, kPa at 20°C: 0.8 Relative vapour density (air = 1): 3.7	Relative density of the vapour/air-mixture at 20°C (air = 1): 1.02 Flash point: 27°C c.c.°C Auto-ignition temperature: 527°C Explosive limits, vol% in air: 1.1-7.0 Octanol/water partition coefficient as log Pow: 3.20				
ENVIRONMENTAL       This substance may be hazardous to the environment; special attention should be given to fish and crustacea.						
NOTES						
Depending on the degree of exposure, periodic medical examination is indicated. The recommendations on this Card also apply to technical xylene. Also consult ICSC # 0084 and 0086 on o- and p-xylene. NFPA Code: H 2; F 3; R 0;						
	ADDITIONAL INF	ORMATION				

ICSC: 0085	© IPCS, CEC, 1993
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# **International Chemical Safety Cards**

# o-XYLENE

$\begin{array}{c} \text{o-XYLENE}\\ \text{ortho-Xylene}\\ 1,2\text{-Dimethylbenzene}\\ \text{o-Xylol}\\ C_6H_4(CH_3)_2/C_8H_{10}\\ \text{Molecular mass: } 106.2\\ \text{CAS \# 95-47-6}\\ \text{RTECS \# ZE2450000}\\ \text{ICSC \# 0084}\\ \text{UN \# 1307}\\ \end{array}$					
EC # 601-022-00-9       TYPES OF HAZARD/ EXPOSURE     ACUTE HAZARDS/ SYMPTOMS     PREVENTION     FIRST AID/ FIRE FIGHTING					FIRST AID/ FIRE FIGHTING
FIRE	Flammable.		NO open flames, NO spar and NO smoking.	ks,	Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Above 32°C explosive vapour/air mixtures may be formed.		Above 32°C use a closed system, ventilation, and explosion-proof electrical equipment.		In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE	KPOSURE		STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN!		
• INHALATION	Dizziness. Drowsiness. N Headache. Unconsciousness.		Ventilation, local exhaust, or breathing protection.		Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
• SKIN	Dry skin. Redness.		Protective gloves.		Remove contaminated clothes. Rinse and then wash skin with water and soap.
• EYES	Redness. Pain.		Safety spectacles.		First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION	Abdominal pain. Burning sensation (further see Inhalation).Do not eat, drink, or smoke during work.		æ	Rinse mouth. Give a slurry of activated charcoal in water to drink. Do NOT induce vomiting. Refer for medical attention.	
SPILLAGE DISPOSAL			STORAGE		PACKAGING & LABELLING
Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe		Fireproof. Separated from strong oxidants. Xn sy R: 10- S: (2-)		mbol 20/21-38 25	

place. Do NOT let this chemical enter the environment.

Note: C UN Hazard Class: 3

SEE IMPORTANT INFORMATION ON BACK

**ICSC: 0084** 

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# **International Chemical Safety Cards**

# **o-XYLENE**

## **ICSC: 0084**

I	<b>PHYSICAL STATE; APPEARANCE:</b> COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR	<b>ROUTES OF EXPOSURE:</b> The substance can be absorbed into the body by inhalation, through the skin and by		
М	CHARACTERISTIC ODOOR.	ingestion.		
Р	<b>PHYSICAL DANGERS:</b> As a result of flow, agitation, etc., electrostatic	INHALATION RISK:		
0	charges can be generated.	A harmful contamination of the air will be reached rather slowly on evaporation of this		
R	Reacts violently with strong oxidants causing			
Т	fire and explosion hazard.	EFFECTS OF SHORT-TERM EXPOSURE:		
А	OCCUPATIONAL EXPOSURE LIMITS (OELs):	The substance irritates the eyes. Exposure far above the OEL may result in central nervous		
Ν	TLV: 100 ppm; 434 mg/m <sup>3</sup> (as TWA) (ACGIH 1993-1994).	death.		
Т	TLV (as (STEL): 150 ppm; 651 mg/m <sup>3</sup> (ACGIH 1993-1994).	EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:		
		The liquid defats the skin. The substance may		
D		resulting in decreased learning ability. Animal		
Α		tests show that this substance possibly causes toxic effects upon human reproduction.		
Т				
Α				
PHYSICAL PROPERTIES	Boiling point: 144°C Melting point: -25°C Relative density (water = 1): 0.88 Solubility in water: none Vapour pressure, kPa at 20°C: 0.7 Relative vapour density (air = 1): 3.7	Relative density of the vapour/air-mixture at 20°C (air = 1): 1.02 Flash point: 32°C c.c.°C Auto-ignition temperature: 463°C Explosive limits, vol% in air: 0.9-7.0 Octanol/water partition coefficient as log Pow: 3.12		
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to fish and crustacea.			
N O T E S				
Depending on the degree of exposure, periodic medical examination is indicated. The recommendations on this Card also apply to technical xylene. Also consult ICSC # 0086 p-xylene and 0085 m-xylene.				
		Transport Emergency Card: TEC (R)-33 NFPA Code: H 2; F 3; R 0;		

ADDITIONAL INFORMATION				
ICSC: 0084 O-XYLENE				
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# **International Chemical Safety Cards**

# **p-XYLENE**

<b>ICSC:</b>	0086
ICDC.	0000

$\begin{array}{c} p-XYLENE\\ para-Xylene\\ 1,4-Dimethylbenzene\\ p-Xylol\\ C_{6}H_{4}(CH_{3})_{2}/C_{8}H_{10}\\ Molecular mass: 106.2\\ CAS \# 106-42-3\\ RTECS \# ZE2625000\\ ICSC \# 0086\\ UN \# 1307\\ EC \# (01,022,00,0)\end{array}$					
TYPES OF HAZARD/ EXPOSURE	TYPES OF HAZARD/ XPOSURE ACUTE HAZARDS/ SYMPTOMS		PREVENTION		FIRST AID/ FIRE FIGHTING
FIRE	Flammable.		NO open flames, NO sparks, and NO smoking.		Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Above 27°C explosive vapour/air mixtures may be formed.		Above 27°C use a closed system, ventilation, and explosion-proof electrical equipment.		In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE	OSURE		STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN!		
• INHALATION	Dizziness. Drowsiness. Headache. Unconsciousness.		Ventilation, local exhaust, or breathing protection.		Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
• SKIN	Dry skin. Redness.		Protective gloves.		Remove contaminated clothes. Rinse and then wash skin with water and soap.
• EYES	Redness. Pain.		Safety spectacles.		First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION	Abdominal pain. Burning sensation (further see Inhalation).		Do not eat, drink, or smoke during work.		Rinse mouth. Give a slurry of activated charcoal in water to drink. Do NOT induce vomiting. Refer for medical attention.
SPILLAGE DISPOSAL		STORAGE		PACKAGING & LABELLING	
Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe		Fireproof. Separated from strong Xn s oxidants. R: 1 S: (2		Xn syn R: 10- S: (2-)	mbol 20/21-38 25

place. Do NOT let this chemical enter the environment.

UN Hazard Class: 3

SEE IMPORTANT INFORMATION ON BACK

**ICSC: 0086** 

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# **International Chemical Safety Cards**

# **p-XYLENE**

# ICSC: 0086

Ι	<b>PHYSICAL STATE; APPEARANCE:</b> COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR	<b>ROUTES OF EXPOSURE:</b> The substance can be absorbed into the body		
М	CHARACTERISTIC ODOUR.	ingestion.		
Р	<b>PHYSICAL DANGERS:</b> As a result of flow, agitation, etc., electrostatic	INHALATION RISK:		
0	charges can be generated.	A harmful contamination of the air will be reached rather slowly on evaporation of this		
R	CHEMICAL DANGERS: Reacts violently with strong oxidants such as	substance at 20°C.		
Т	nitric acid.	EFFECTS OF SHORT-TERM EXPOSURE:		
_	OCCUPATIONAL EXPOSURE LIMITS	The substance irritates the eyes. Exposure far		
Α	(OELs):	above the OEL may result in central nervous		
Ν	TLV: 100 ppm; 434 mg/m <sup>3</sup> (as TWA) (ACGIH 1993-1994).	death.		
Т	TLV (as STEL): 150 ppm; 651 mg/m <sup>3</sup> (ACGIH 1993-1994).	EFFECTS OF LONG-TERM OR		
		The liquid defats the skin. The substance may		
D		have effects on the central nervous system,		
D		resulting in decreased learning ability. Animal		
Α		toxic effects upon human reproduction.		
Т				
А				
PHYSICAL PROPERTIES	Boiling point: 138°C Melting point: 13°C Relative density (water = 1): 0.86 Solubility in water: none Vapour pressure, kPa at 20°C: 0.9 Relative vapour density (air = 1): 3.7	Relative density of the vapour/air-mixture at 20°C (air = 1): 1.02 Flash point: 27°C c.c.°C Auto-ignition temperature: 528°C Explosive limits, vol% in air: 1.1-7.0 Octanol/water partition coefficient as log Pow: 3.15		
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to fish and crustacea.			
<u> </u>				
Depending on the degree of exposure, periodic medical examination is indicated. The recommendations on this Card also apply to technical xylene. Also consult ICSC # 0084 o-xylene and 0085 m-xylene.				
		NFPA Code: H 2; F 3; R 0;		

ADDITIONAL INFORMATION				
ICSC: 0086		p-XYLENE		
© IPCS, CEC, 1993				
IMPORTANT LEGAL NOTICE:	Neither the CEC or the IPCS nor any p responsible for the use which might be views of the IPCS Peer Review Comm requirements included in national legis the cards with the relevant legislation in	erson acting on behalf of the CEC or the IPCS is made of this information. This card contains the collective ittee and may not reflect in all cases all the detailed lation on the subject. The user should verify compliance of n the country of use.		

# **ATTACHMENT 4**

# NIOSH FAST FACTS FOR PROTECTING YOURSELF FROM HEAT STRESS

# PROTECT YOUR WORKERS FROM

# **Develop an acclimatization plan**

**Acclimatization** is the result of beneficial physiological adaptations (e.g., increased sweating efficiency and stabilization of the circulation) that occur after gradual increased exposure to a hot environment.



# Emphasize the need for appropriate clothing

Encourage workers to wear clothing that is...

breathable —

light-colored

Cotton clothing can be soaked in water to aid cooling.



Be aware that protective clothing or **personal protective equipment** may increase the risk of heat stress.





# Encourage workers to drink plenty of fluids...

...such as drinking small amounts of water before becoming thirsty.

During moderate activity in moderately hot conditions, workers should drink about...

# 1 cup every15 to 20 minutes.



Learn more about heat stress at: www.cdc.gov/niosh/topics/heatstress

#### DEPARTMENT OF HEALTH AND HUMAN SERVICES

Centers for Disease Control and Prevention National Institute for Occupational Safety and Health



# ATTACHMENT 2 TESTAMERICA SOPS AND HOLDING TIMES



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# Analysis of Semivolatile Petroleum Hydrocarbons In Water and Soil: NWTPH-Dx (GC/FID) and AK102/103

Approvals:				
Terri Torres Quality Assurance Manager	Date	Chris B. Williams Laboratory Director	Date	

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#### 1.0 SCOPE AND APPLICATION

#### 1.1 <u>Analytes, Matrix(s), and Reporting Limits</u>

This method is designed to measure, by GC-FID analysis, the concentration of semi-volatile petroleum products in soil from sites where the petroleum products are known, unknown, and/or when multiple types of petroleum products are suspected to be present. Semi-volatile products are defined as products that elute from jet fuels to heavy fuel oils and encompass petroleum products containing components from  $n-C_{10}$  to  $n-C_{36}$  range.

The reporting limits for soils are 10 mg/kg for Diesel range and diesel range products such as kerosene and jet fuel; 25 mg/kg for Heavy oil range and petroleum products in the elution range beyond Diesel #2.

The reporting limits for waters are 0.25 mg/L for Diesel range and diesel range products such as kerosene and jet fuel; 0.50 mg/L for Heavy oil range and petroleum products in the elution range beyond Diesel #2.

Summary of incorporated methodologies				
Northwest – DRO/AK102	NWTPH-Dx/AK102	n-C10 through n – C24		
Northwest – RRO/AK 103	NWTPH-Dx/AK103	n-C25through n – C36		

#### Summary of Incorporated Methodologies

On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in the Quality Assurance Manual.

#### 2.0 <u>SUMMARY OF METHOD</u>

This method provides gas chromatographic conditions for the detection of semi-volatile petroleum products such as diesels and high molecular weight products. Other non-petroleum compounds with similar characteristics and boiling points may also be detected with this method. One liter of water or 30 grams of soil is the recommended sample size. Samples must be spiked with a surrogate compound and extracted with methylene chloride. The extract is dried and concentrated to a known volume. An aliquot of the extract must be injected into a capillary column gas chromatograph equipped with a flame ionization detector (FID), which has been temperature programmed to facilitate separation of organic compounds. Quantitation for DRO must be performed by comparing the total chromatographic area between and including the peak start of  $C_{10}$  to the peak start of  $C_{25}$ , including both resolved and unresolved components, based on FID response compared to a diesel calibration standard. Quantitation for RRO must be performed by comparing the total chromatographic area between the peak start of  $C_{25}$  and the peak end of  $C_{36}$ , both resolved and unresolved components, based on FID response compared to a blended commercial standard called the Residuals Calibration Standard. Integration must be performed using forced baseline-baseline integration.

Summary of Fraction Quantitation minto				
	Water (mg/L)	Soil(mg/kg)		
Northwest – DRO/AK102	0.25	10		
Northwest – RRO/AK103	0.50	25		

#### **Summary of Practical Quantitation limits**

## 3.0 **DEFINITIONS**

**3.1** <u>**Diesel range organics (DRO):**</u> All chromatographic peaks, both resolved and unresolved, eluting in the diesel range from approximately the peak start of n-decane (C10) to the peak start of C25. See Table 1 for specific DRO ranges for each analysis. Quantitation is based on direct comparison of the area within this range to the total area of the diesel standard as determined from FID response using baseline - baseline integration.

**3.2** <u>Residual range organics (RRO):</u> All chromatographic peaks, both resolved and unresolved, eluting in the lube oil range from approximately the peak start of C25 to the peak end of C36. See Table 1 for specific RRO ranges for each analysis. Quantitation is based on direct comparison of the area within this range to the total area of the motor oil standard as determined from FID response using baseline - baseline integration.

**3.3** <u>Diesel Calibration Standard (DCS)</u>: A commercially prepared, certified diesel # 2 standard, diluted to the appropriate concentrations. This standard serves as the initial calibration and continuing calibration standard for diesel range organics and total extractable organics.

**3.4 Residual Calibration Standard (RCS):** A commercially prepared, certified blend of equal weights of 30 weight and 40 weight Motor oil products diluted to the appropriate concentrations. This standard serves as the initial calibration and continuing calibration standard for residual range organics.

**3.5** <u>Surrogate Control Standard (SCS)</u>: o-terphenyl and n-triacontane, used as a laboratory control.

**3.6** <u>Surrogate Control Sample:</u> A reagent water or standard blank soil sample spiked with the SCS. The surrogate recovery is used as a laboratory control.

**3.7** <u>Method Blank:</u> An analytical control consisting of all reagents and carried through the entire analytical procedure. The method blank is used to define laboratory background contamination.

**3.8** <u>Laboratory Control Sample (LCS)/Blank Spike (BS):</u> A method blank sample spiked with the Diesel # 2 CVS, which is used as a quality control check. This is from a different source than that used for calibration. The spike recovery is used to evaluate method control.

**3.9** <u>Retention Time Standard (RTS):</u> A commercially prepared mixture of alkanes including n-C8 to C40. This standard serves to verify expected boiling point range for petroleum products, and defines the retention time window for diesel range organics and residual range organics.

**3.10** <u>Matrix Spike (MS):</u> An aliquot of sample spiked prior to extraction with known quantities of specific target compounds and carried through the entire analytical procedure. The matrix spike is used to assess method performance and extraction efficiency.

**3.11** <u>Matrix Spike Duplicate (MSD):</u> A second aliquot of sample spiked, prepared and analyzed identically to the matrix spike. The relative percentage difference (RPD) between the MS and MSD is used to assess method precision.

**3.12** <u>Analytical Batch:</u> A group of 20 or less samples prepared and/or processed together within the same shift using the same reagents. Each batch must contain a minimum QC of one

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method blank, one laboratory control sample, one matrix spike and one duplicate in the form of either a sample duplicate of matrix spike duplicate. Samples from Alaska must contain an LCS duplicate. NWTPHDx samples must contain one duplicate for every 10 samples.

**3.13** <u>Initial Calibration Verification (ICV)</u>: A standard, made from a second source other than that used to produce the calibration curve, that is used to verify the accuracy of the calibration curve.

**3.14** <u>Continuing Calibration Verification (CCV)</u>: A standard run once every 10 samples that is used to ensure the continuing validity of the calibration curve. For diesels and oils, this standard is made from the same source as used to make the calibration curve.

## 4.0 INTERFERENCES

**4.1** Non-petroleum organics, such as leaf litter or bark, may contribute to biogenic interferences. If this is a problem, a sulfuric acid/silica gel clean up procedure should be used. Alaska samples may not be subjected to a sulfuric acid cleanup.

## 5.0 <u>SAFETY</u>

Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

#### 5.1 Specific Safety Concerns or Requirements

Methylene chloride creates excessive pressure very rapidly. Initial venting must be done immediately after the sample has been sealed and inverted. Vent in to hood away from analysts.

Samples that contain high concentrations of carbonates or organic material or samples that are at elevated pH can react violently when acids are added.

#### 5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the SDS for each of the materials listed in the table. A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the SDS for each material before using it for the first time or when there are major changes to the SDS.
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Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure	
Methylene Chloride	Carcinogen Irritant	25 ppm- TWA 125 ppm- STEL	Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light- headedness, fatigue, nausea, vomiting and headache. Causes irritation, redness and pain to the skin and eyes. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.	
Hydrochloric Acid	Corrosive Poison	5 ppm Ceiling	Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death. Can cause redness, pain, and severe skin burns. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.	
1 – Always add acid to water to prevent violent reactions.				
2 – Exposure limit refers to the OSHA regulatory exposure limit.				

## 6.0 EQUIPMENT AND SUPPLIES

## 6.1 Instrumentation

**6.1.1** <u>Analytical System:</u> HP 5890 Gas Chromatograph with dual FID detectors. HP Chemstation facilitates data acquisition.

**6.1.2** <u>Capillary Column</u>: ZB1-HT(Crosslinked dimethylpolysiloxane): 15 meter x 0.25 mm ID with 0.25 um film thickness or equivalent

### 6.1.3 Suggested Flow Rates:

Flow Rate	Setting
Carrier Flow	Hydrogen @ 8 mL/min
Detector Hydrogen Flow	25 mL/min
Detector Air Flow	100 mL/min

## 6.2 <u>Supplies</u>

- Syringes
- Silanized glass wool (for GC liners)
- Analytical balance capable of weighing to 0.0001 grams
- Volumetric flasks
- Disposable Pasteur pipettes
- ALS vials and screw caps

## 7.0 REAGENTS AND STANDARDS

Preparation of reagents and standards will be documented in the LIMS system. All standards will be stored at Manufactures suggested temperatures, whether at room temperature or in a freezer below 0 C.

7.1 <u>Methylene Chloride</u>: pesticide grade or better.

7.2 <u>Surrogates:</u> o-terphenyl and n-Triacontane

7.2.1 <u>Stock Standard:</u> purchased as neats.

**7.2.2** <u>Working Stock Solution</u>: Make a working stock solution of 2,000 μg/mL by diluting 0.2 grams of o-terphenyl and 0.2 grams of n-Triacontane into a total volume of 100 ml methylene chloride.

**7.2.3** <u>Surrogate Spiking Solutions:</u> Each sample and standard will be spiked with 100  $\mu$ l of surrogate spiking solution. At final volume, each extract will have a surrogate concentration of 8  $\mu$ g/mL.

**7.2.4** <u>Soil/Water</u>; 400  $\mu$ g/mL: 5mL of Working Stock Solution is diluted to 25mL with 1:1 DCM:Acetone.

## 7.3 <u>Laboratory Control Spike (or Matrix Spike)</u>

**7.3.1** The Diesel #2 Spike standard is purchased at 50,000 ug/mL and is diluted 12.5X with acetone (800uL to 10mL) for water, and 5X with acetone (2mL to 10mL) for soil. Each LCS and MS sample are spiked with 100uLs such that the final concentration of spiked DRO is 200ug/mL. These spikes are applied to both AK 102 and NWTPH methods.

**7.4** <u>Primary Stock Standards:</u> A #2 diesel standard at 50,000 μg/mL and a motor oil standard at 50,000 μg/mL are purchased.

**7.5** <u>Primary Working Solutions:</u> The working solution for the initial calibration contains 10,000 ug/mL diesel, 10,000ug/mL oil, and 400 ug/mL surrogate. It is prepared by combining and diluting 2 mLs each of the following: #2 Diesel Primary Stock Solution (7.4), Oil Primary Stock Solution (7.4), and Surrogate Working Stock Solution (7.2.2) to 10 mLs in methylene chloride.

**7.5.1** 200 ug/mL CCV solution made by diluting 100 uL of the parent working solution described in 7.5 to a final volume of 5mL in methylene chloride.

**7.6** <u>Calibration Curve</u>: The calibration curve is made by diluting the Primary Working Solution (7.5) with methylene chloride in the following amounts:

Final ppm	Volume 10,000 stock	Volume 200 CCV	Volume MeCl2
diesel/oil/surrogate	<u>(Rgt. 7.5)</u>	Working (Rgt. 7.5.1)	
5/5/0.2		25uL	975uL
10/10/0.4		25uL	475uL
20/20/0.8		50uL	450uL
100/100/4		150uL	150uL
200/200/8	20uL		980uL
1000/1000/40	100uL		900uL
2000/2000/80	200uL		800uL
5000/5000/200	500uL		500uL
10000/10000/400	1000uL		OuL

## 7.7 Initial Calibration Verification (ICV, second source) Standards:

**7.7.1** Diesel Initial Calibration Verification (ICV) Standard: A stock #2 diesel standard at 50,000  $\mu$  g/ml is purchased from a different vendor or is of a different lot than the primary stock used to prepare the calibration curve.

**7.7.2** <u>Oil ICV Primary Stock Standard:</u> Oil ICV Primary Stock Standard: A 50,000ug/mL RRO standard is prepared by diluting neat commercial motor oil. 0.25 grams of Valvoline SAE 30 and 0.25 grams SAE 40 conventional motor oil are combined and diluted to 10 mL with MeCl2. This standard is used to prepare the RRO spiking solution for AK 103.

**7.7.3** <u>Working ICV:</u> The 50,000 ug/mL diesel ICV standard (7.8.1) and the 50,000 oil Intermediate Standard (7.8.2), and the 2,000 ug/mL surrogate working stock are combined and diluted in methylene chloride to 10,000 ug/mL each DRO/RRO and 400 ug/mL surrogates (1 mL each into 5 mL DCM). This solution is diluted to 200-200-8 ug/mL (200uL into 10mL DCM).

**7.8** <u>Retention Time Standard:</u> A commercially prepared standard that contains alkanes C6, C10, C25 and C36. This component mix is used to define the retention time window for DRO and RRO. (Restek AK Retention Time Marker or equivalent).

## 8.0 SAMPLE COLLECTION, PRESERVATION, SHIPMENT AND STORAGE

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Motrix	Sample	Min. Sample	Drocorvation	Holding Time	Deference
Wiatrix	Container	Size	Freservation	noiding time	Reference
Waters	250mL	250mL	HCI, pH < 2;	14 Days;	NWTPH-Dx,
	<i>a</i> mber		Cool 4 ± 2°C	Extracts must	AK102/103
	glass with			be analvzed	
	Teflon			within 40 Davs	
	lined cans			mann to Dayo	
	lineu caps				
	Sample	Min. Sample			
Matrix	Container	Size	Preservation	Holding Time	Reference
Soils	4 -8 oz.	60 grams	Cool 4 ± 2°C	14 Days;	NWTPH-Dx,
	glass	C C		Extracts must	AK102/103
	<b>U</b>			be analyzed	
				within 40 Days <sup>1</sup>	
				within +0 Days	

Aqueous samples are extracted according to the procedures detailed in SP-EXT-006 (EPA 3510C).

- Solid samples are extracted according to the procedures detailed in SP-EXT-001 (EPA 3550B).
- Extracts should be stored at  $\leq$ -10°C.

## 9.0 QUALITY CONTROL

Parameter	<u>MB</u> <sup>1</sup>	LCS/LCSD/M S/MSD	<u>Surrogates</u>		LCS RP	<u>5/MS</u> 2 <u>D</u> *	<u>Dup</u>	<u>RPD</u>
			QC	Samples	<u>soil</u>	water	<u>soil</u>	water
Northwest – DRO	< MRL	50-150%	50-150%	50-150%	<u>&lt;</u> 25	32.5	<u>&lt;</u> 40	<u>&lt;</u> 25
Northwest – RRO	< MRL	50-150%	50-150%	50-150%	<u>na</u>	na	<u>&lt;</u> 40	<u>&lt;</u> 25
AK 102	< MRL	70-125%	60-120%	50-150%	<u>&lt;</u> 20	<u>&lt;</u> 20	<u>&lt;</u> 40	<u>&lt;</u> 25
AK 103	< MRL	60-120%	60-120%	50-150%	<u>&lt;</u> 20	<u>&lt;</u> 20	<u>&lt;</u> 40	<u>&lt;</u> 25

\*Statistical control limits are updated annually in LIMS. LCSD analyzed for AK methods only.

<sup>1</sup> When analytes are detected at levels above the MRL, then any results for the analyte in client samples should be qualified as potential laboratory contaminants, unless the contamination represents less than 5% of the concentration present in client sample.

## 9.1 Suggested Corrective Actions

Guidance for corrective action has been included below. These actions should be performed in coordination with a supervisor or department manager:

**9.1.1 AK102/103** – For AK102/103 Methods the following must be carried through all stages of the sample preparation and measurement steps per batch of 20 samples: One MB, one LCS\LCSD pair, one MS, and one DUP. The LCS\LCSD will be examined to determine accuracy. LCSD will be analyzed for AK methods only.

**9.1.2 NWTPH-Dx** – For the NWTPH-Dx Method the following must be carried through all stages of the sample preparation and measurement steps per batch of 20 samples: One MB, one LCS, one MS, and two DUP's (If the batch contains 10 or less samples one duplicate is sufficient). The LCS will be examined to determine accuracy.

**9.1.3** A solvent blank must be analyzed each day to determine the area generated on normal baseline noise as well as after a highly concentrated sample to show lack of carry-over on equipment. If a blank shows contamination above the MRL, the column should be baked out and subsequent blanks reanalyzed until the system shows levels less than the MRL.

**9.1.4** The LCS / LCSD will be prepared and processed in the same manner as the associated samples. Analysis of the LCS will occur after the MB and before the samples. Analysis of the LCSD will occur after the last sample associated with the extraction batch is analyzed (AK methods only). Accuracy will be measured by the percent recovery (%R) of the LCS and LCSD. Precision will be measured by the reproducibility of the duplicate sample, if available. Results must agree within limits defined in Section 9.0 to be considered acceptable.

**9.1.5** If either/both spike recoveries fall outside of acceptance range, they must first be re-analyzed to verify the recoveries. If results are duplicated, the entire extraction batch must be re-extracted and re-analyzed. Exception may occur if the LCS/LCSD recoveries are high and the associated samples do not contain any DRO. The situation will be assessed and the need to re-extract the samples may be deemed un-necessary. Appropriate documentation of the high recoveries will be completed. This applies to both water and soil LCS/LCSD samples.

**9.1.6** Surrogate compounds are used to measure performance of the analysis. Results must agree within limits defined in Section 9.0 to be considered acceptable.

**9.1.7** Each time an analytical sequence is started, the standard solution must be evaluated to determine if the chromatographic system is operating properly. The analyst should consider--Do the peaks look normal, is the response obtained comparable to the response from previous calibrations? Careful examination of the standard chromatogram can indicate whether the column is still good, the injector is leaking, the injector septum needs replacing, etc..

**9.1.8** The laboratory must maintain records to document the quality of the data generated. When results of sample spikes indicate irregular method performance, a quality control check standard must be analyzed to confirm that the measurements were performed in an in-control mode of operation.

**9.1.9** Before analysis of any samples, the analyst should demonstrate, through the analysis of a MB that interferences from the analytical system, glassware and reagents are under control. Control criteria are discussed above.

**9.1.10** Each day that analysis is performed, the daily calibration sample should be measured to determine if the chromatographic system is operating properly. If any changes are made to the chromatographic system, recalibration of the system must take place.

**9.1.11** Over range response: Target analytes with responses above the highest level of the initial calibration must be re-analyzed at a dilution.

**9.1.12** Sample Duplicates: When sample duplicates are outside of the established control limit, then the batch QC should be evaluated for matrix interference and qualified appropriately. If evaluation of the remaining batch QC indicates that re-analysis of the sample will result in similar results, then the sample should not be re-analyzed.

### 9.1.13 Surrogate Recovery:

- If surrogate recoveries are biased high, evaluate the chromatogram and determine if it is due to the level of DRO or interferences present in the sample. Write a NCM (non-conformance memorandum), and address in the situation in the case narrative. If surrogate recoveries are high and the sample is non-detect for DRO, write a NCM. Re-extraction may be necessary if required by client. In some instances if surrogates are high and the sample is non-detect, no further action will be required. Consult with the Department Manager or Project Manager to determine action required.
- If the surrogate recoveries are low, check to be sure that there are no errors in the calculations or surrogate solutions. Re-analyze the sample(s).
- Check instrument performance. If a problem is identified with the instrument, correct the problem and re-analyze the extracts.
- If no instrument problem is found, the sample should be re-extracted and re-analyzed. An NCM
  must be initiated so that the Project Manager, Laboratory Director and client are notified of the
  situation. If the holding time for the extraction has expired report both sets of data. Note in the
  narrative if holding times were expired, if surrogate recoveries were still outside of control, or if
  the re-extract provided acceptable recoveries.

Trip blanks may also accompany samples and are used to show whether contamination could have occurred during transport to the lab. If a trip blank is reanalyzed and results improve, all associated samples must also be reanalyzed.

## 10.0 PROCEDURE

### 10.1 Sample Preparation

- Liquids Refer to SP-SOP-EXT-006 (EPA 3510C) for extraction.
- Solids Refer to SP-SOP-EXT-001 (EPA 3550C) for extraction.
- Refer to TA-S-SPL-003 for Moisture Determination in Soils.

## 10.2 Initial Calibration

The minimum criteria for an initial calibration are five points. One of the external standards should be at or below the Quantitation limit. The other concentrations should correspond to the expected range of concentrations found in the real samples or should define the working range of the detector.

<b>,</b>						
<u>NWTPH (WA)</u>	Initial (%RSD)	Continuing (%D)				
DRO	15	15				
RRO	15	15				
<u>AK</u>	<u>% Recovery</u>	<u>% Recovery</u>				
AK102	75-125	75-125				
AK103	75-125	75-125				

## Summary of Initial and Continuing Calibration acceptance criteria

## **10.2.1** Criteria for Initial Calibration

**10.2.1.1** One of the calibration levels must be at or below the reporting limit.

**10.2.1.2** The other concentrations should correspond to the expected range of concentrations found in the samples or should define the working range of the detector.

**10.2.1.3** As stated above, the minimum criterion for an initial calibration is five points with a percent RSD of less than 15% or a correlation coefficient (r)  $\ge$ 0.990 for least squares regression (unless otherwise specified by a client's DQO or technical requirement). <u>NOTE: All points must</u> be within 15% of true value for the DX method.

**10.2.1.4** Calibration points may be rejected because of non-linearity if they are the highest or lowest data points. Points within the curve may not be rejected without a means test or an analytical reason (i.e. poor injection). The data for the rejected point must be included with the Initial calibration package with reason for the data's rejection. If the lowest calibration point corresponds to the reporting limit and is rejected, the reporting limit must be elevated so that it corresponds to the new lowest calibration point.

**10.2.1.5** A mid-point 2<sup>nd</sup> source standard, the initial calibration verification standard (ICV), is used as a validation test for an initial calibration. See Sec. 10.2 for acceptable criteria for each analysis.

Suggested Corrective Action:

- reanalyze the standard curve;
- prepare new stock and/or working standards.

**10.2.1.6** <u>Rejecting Data Points</u>: Refer to the Corporate Procedure, CA-Q-P-003, Calibration Curves and the Selection of Calibration Points.

## 10.3 <u>Retention time window</u>

**10.3.1** A retention time study must be performed when, in the analyst's judgment, the instrument conditions have changed (i.e. new column) and updated no less than once a year. The study must consist of a minimum of three (RTS) standards. Each standard must be separated chronologically by a minimum of one day and maximum of three days. The window is defined as (+/-) 3 times the standard deviation of the three standards.

## 10.4 <u>Continuing Calibration</u>

**10.4.1** Verification of the initial calibration is performed by analysis of a mid-point calibration standard at the beginning and end of each analytical sequence. Within the sequence a continuing calibration verification (CCV) standard is analyzed for every ten analytical samples. Rinse blanks or CCBs should not be analyzed before the CCV (except for the start of the sequence, see 10.5.1) unless they're analyzed between each sample in the sequence. See Sec. 10.2 for CCV %D acceptance criteria.

Suggested Corrective Action:

- repeat the CCV to verify proper preparation;
- prepare a new CCV from original stock;
- check for instrument drift;
- recalibrate with new standard curve and repeat all samples since the previous in control CCV;
- prepare new stock and/or working standards.

### Suggested Maintenance

When any of the criteria is out of control, one or more of the following actions may be necessary:

- Change the septum.
- Change disposable glass injector insert if discolored.
- Remove ~12 inches from the front of the column.
- Check and adjust all flows.
- Bake the injector, oven or detector at approximately 20°C above normal.

## 10.5 <u>Sample Analysis</u>

**10.5.1** The first sample in the sequence should begin with an instrument (solvent) blank to demonstrate the absence of contamination prior to analysis.

**10.5.2** A solvent blank may be analyzed each day to determine the area generated on normal baseline noise as well as after a highly concentrated sample to show lack of carry-over on the equipment. If a blank shows contamination above the RL, the column should be baked out and subsequent blanks reanalyzed until the system shows levels less than the RL.

**10.5.3** Extracts are allowed to reach room temperature (if necessary) and analyzed on the GC.

**10.5.4** If the sample concentration exceeds the linear range of the calibration, the extract must be diluted and reanalyzed.

## 10.6 Evaluation of Analytical Data

**10.6.1** <u>Identification</u> - Direct comparisons of sample chromatograms to retention times and peak patterns of standard product chromatograms achieve identification of diesel, motor oil, and/or other products. The analyst should generate a value for diesel range organics and qualitatively identify diesel and any other products when reporting data. The analyst's experience weighs heavily in interpreting the chromatogram. Environmental samples may contain more than one type of product and loss of light end components may occur with weathering.

**10.6.2** <u>Integration</u> - Interpretation of data generated by the GC is best accomplished using a sophisticated data acquisition system. TA specifically uses the Enviroquant HP Chemstation to gather, interpret, and project data.

**10.6.2.1** The integration for any petroleum product is done by projecting a horizontal baseline over the appropriate range,  $C_{10}$  - start  $C_{25}$  for diesel range organics and  $C_{25}$  start -  $C_{36}$  for residual range organics (heavy oil). Quantitation is forced to that baseline.

**10.6.2.2** It is important not to include surrogates into the DRO/RRO area. The surrogate quantitation is forced valley to valley.

**10.6.2.3** To prevent this, surrogates are tangent-skimmed out of the DRO/RRO. In order to obtain an accurate baseline integration, a column compensation run may be performed using the analyst's discretion.

**10.6.2.4** For analysis of samples with suspected high levels of heavy hydrocarbons, it is recommended that an instrument blank be run between samples to verify that there is no resulting carryover.

### 10.6.3 Reporting

**10.6.3.1** A compound result may not be reported unless it is bracketed by continuing calibrations that are within the established acceptance criteria (Table 04).

**10.6.3.2** Results for soil samples are reported on a dry-weight basis.

**10.6.3.3** Anomalous situations occurring during sample preparation or analysis should be documented on the bench sheet and non-conformance reports should be issued, if necessary. Possible anomalous situations resulting in non-conformance reports include loss of a sample or batch QC through spillage or breakage. Please see the SOP for Non-Conformances, SP-QAG-012.

### 10.7 Data Review

- **10.1** Upon completion of the initial calibration run, the primary analyst acknowledge any TALS Data Review Checker (DRC) findings, add appropriate NCMs, and document the review on the data review checklist in TALS.
- **10.2** Upon completion of the analytical run, the primary analyst must review all data for compliance with criteria documented above, acknowledge any Data Review Checker

(DRC) findings in TALS, and document the review on the data review checklist in DRC.

**10.3** Upon completion of the primary review, the Department Supervisor (or designate) must perform a secondary peer review (see SP-QAG-023). The secondary reviewer completes the remaining items on the DRC checklist.

## 11.0 CALCULATIONS / DATA REDUCTION

11.1 External Standard Calibration = 
$$Cs = \left(\frac{Ax \times A \times Vt \times D}{As \times Vs}\right)$$

Where:

Cs = Concentration of DRO in sample (mg/L or mg/kg) Ax = Response for the DRO in the sample, units in area As = Response for the external standard, units same as for Ax A=External standard concentration (mg/mL) Vt = Volume of final extract in mL

D = Dilution factor, if dilution was performed on the sample prior to analysis.

If no dilution was made, then D = 1.

Vs = Amount of sample extracted in L or kg

## 11.2 <u>Standard Deviation (SD) and Relative Standard Deviation (RSD)</u>

$$SD = \sqrt{\frac{\sum_{i=1}^{n} (RF_i - \overline{RF})^2}{n-1}} \qquad \qquad RSD = \frac{SD}{\overline{RF}} \times 100$$

Where:

 $\underline{RFi} = RF$  for each of the calibration standards RF = mean RF for each compound in the initial calibration n = Number of calibration standards, e.g., 5

## 11.3 <u>Relative Percent Difference (RPD)</u>

$$RPD = \frac{|Original \ sample \ value - Duplicate \ sample \ value|}{[(Original \ sample \ value + Duplicate \ sample \ value)/2]} \times 100$$

**11.4** ICV, CCV, LCS Percent Recovery (%R) = 
$$\% R = \frac{Observed concentration}{Known concentration} \times 100$$

## 11.5 MS % Recovery (%R)

$$\% R = \frac{(Spiked \ sample \ concentration) - (Unspiked \ sample \ concentration)}{Spiked \ concentration} \times 100$$

## 12.0 MAINTENANCE GUIDE FOR GC SYSTEMS

See Attachment 1: Semivolatile GC Maintenance

## 13.0 METHOD PERFORMANCE

#### 12.1 Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure in the QA Manual. MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency or whenever there is a significant change in instrumentation or analytical methodology.

### 12.2 <u>Demonstration of Capabilities</u>

An initial demonstration of capability shall be performed before a new instrument or analytical method is brought into production.

Initial demonstrations of capability and annual demonstrations of capability or passing annual PE results are required for each analyst.

#### 12.3 <u>Training Requirements</u>

See SP-QAG-026 for general training requirements.

### 14.0 POLLUTION CONTROL

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention."

### 15.0 WASTE MANAGEMENT

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to SP-SPL-006. All wastes resulting from the utilization of this SOP must be handled in accordance with current regulatory requirements. In the event of any questions, the Laboratory Director and/or the Compliance Officer should be consulted.

The following waste streams are produced when this method is carried out.

- Sample vials containing solvents will be placed in the drum labeled "Flammable Vials" for disposal.
- Expired standards will be turned into the Waste Technician for disposal.

## 16.0 <u>REFERENCES / CROSS-REFERENCES</u>

**15.1** "Analytical Methods for Petroleum Hydrocarbons- NWTPH-Dx Method- Semivolatile Petroleum Products Method for Soil and Water" Washington State Department of Ecology. June 1997

**15.2** Method AK102 for Determination of Diesel Range Organics, State of Alaska Department of Environmental conservation, State Chemistry Laboratory, Mary Jane Pilgrim, Ph.D., version 3-1-99.

**15.3** Method AK103 for Determination of Residual Range Organics, State of Alaska, Department of Conservation, State Chemistry Laboratory, Mary Jane Pilgrim, Ph.D., version 3-1-99.

- **15.4** TA Quality Assurance Manual.
- **15.5** TA Safety Manual.
- **15.6** SP-EXT-001 Preparation of Solids and Soils for Semi-volatile Analysis by EPA 3550C
- **15.7** SP-EXT-006 Preparation of Liquids for Semi-volatile Analysis by EPA 3510C
- **15.8** SP-QAG-026 Basic Employee Training
- **15.9** SP-QAG-023 Data Review and Reporting of Analytical Results
- 17.0 METHOD MODIFICATIONS None

### 18.0 ATTACHMENTS

Attachment 1: Semivolatile GC Maintenance

### 19.0 REVISION HISTORY

### Revision 14, dated 03.14.19

- Added bottle requirements for waters from 1L to 250mL
- Added the calibration information about each point being within 15 % of true value for the DX method.

### Revision 13, dated 11.13.18

• Added storage requirements for standards, section 7.0

### Revision 12, dated 9.6.17

- Added Maintenance Section, 12.0
- Replaced Attachment 1 with Semivolatile GC Maintenance.
- Removed attachment 2
- Updated section 10.7 for data review checker (DRC)

### Revision 11, dated 10.27.16

• Biannual review.

- Removed the Water surrogate. Soil surrogate and spike are used for waters now, section 7.2.4.
- Added GC Semivolatile TPH Initial Calibration Data Review Checklist, Attachment 1
- Updated QCAR to Data review checklist, Attachment 2

## Revision 10, dated 12.5.14

• Added reference to AK102-SV, sections 8.0, 10.1, 10.2

## Revision 09: 11/20/2014

- Added QAM signature
- Added file location

## Revision 8: 06/27/2014

• Section 10.5.4: removed references to diluting samples and rerunning if sample was greater than 15% above calibration. Sample must be diluted if they are over calibration.

• Section 15.6 was changed to EPA 3550C and not 3550B. Our current SOP is for 3550C.

## Revision 7: 06/20/2014

• Separated QC requirements in section 9.1.1 for AK and NW methods to make them more clear to analysts.

• Changed QCAR to more clearly reflect CCV requirements for NW method as well as adding the Dup requirement to the QC section for NW method

### Revision 6: 05/16/2014

• Defined frequency of duplicates to 1/10 samples in response to Washington Dept. of Ecology audit.

### Revision 5: 02/20/2014

• General review, updated calibration standard preparation tables and QC tables to reflect current practice.

Revision 4: 02/19/2012

• General review, added AK102/103 to SOP

Revision 3: 02/04/2010; Reasons for Change:

- Updated format to corporate specifications
- Removed details and references related to AK methods, since there are AK SOPs.
- Added second source for motor oil in section 7.8.2
- Updated corrective actions in section 9
- Removed quadratic option in section 10.1.2.3
- Updated calculation algorithms in section 11.
- Updated MDL information in 12.1
- Added waste streams in section 14.0
- Added QCAR as an Attachment

## Attachment 1. Semivolatile GC Maintenance

## Daily Maintenance Checklist

- Replace injector septa daily for each inlet depending on sample load.
- Refill solvent rinse vials and empty solvent waste vials.
- All gas cylinders are checked and changed if the pressure is less than 500 psi.

## **Routine Instrument Maintenance**

The following activities constitute routine maintenance procedures and are performed either Mondays and Thursdays, or as necessary.

- Clip Column;
- Install new injection port liner;
- Install new septum;
- Install new gold seal and washer, or equivalent;

## Injector port maintenance is performed whenever the following conditions exist:

- High column bleed
- Peak broadening and/or tailing for polar analytes such as phenols
- Loss of sensitivity
- Calibration failures due to a loss of response
- Retention time drift
- Long or training solvent tail
- Overall loss of instrument response

Clean the inside of the injector body with a cotton swab dipped in hexane. Allow to air dry, and then replace the liner with a new or reconditioned liner that has been solvent rinsed, and muffled at 400 $^{\circ}$ C. re-pack the glasswool in the re-conditio ned liner, replace the septum and tighten the nut just past finger tight.

If column clipping is required, cool the inlet down to 45°C. Using a ceramic column cutter, remove at least 4 cm of the column end, depending on the severity of the system contamination. Place a column nut and new ferrule over the end of the column and re-cut one inch from the column end to ensure that no ferrule fragments remain in the column. Feed the column into the tapered liner until seated, then hold pressure on the column while the nut is tightened to one turn past finger tight. At this point, the GC inlet is brought up to operating temperature. The system should then be leak checked.

## Detectors

• Columns are removed, cut and re-inserted.

### Parts List

• Vespel/Graphite compact ferrules 0.8mm ID (Restek 20263), 0.5mm ID (Restek 20248), 0.4mm ID (Restek 20238).

- Injector Septa, 11mm diameter (Restek 20364)
- Glass Inlets: 2mm ID Goosneck Splitless (Restek 20796), 4mm Splitless sleeve w/FS Wool (Restek 22401), 2mm ID Splitless-Quartz (Restek 20915).
- Viton o-rings (Restek 20377)
- Gold Seals (Restek 21317)
- Column cutter (Crystal and Ceramic)

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- Flow measurement device
- GC tools and wrenches
- Snoop leak detection liquid
- Gas Purifier (Supelco OM-1)



Environment Testing TestAmerica

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# Determination of Gasoline Range Hydrocarbons by Gas Chromatography-Mass Spectroscopy (GC-MS) NWTPH-Gx, AK101

Approvals (Signature/Date):				
Terri Torres Quality Assurance Manager	Date	Randee Arrington Laboratory Manger	Date	

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## 1.0 <u>Scope and Application</u>

### 1.1 <u>Analytes, Matrix(s), and Reporting Limits</u>

This method is used to determine the concentration of gasoline range hydrocarbons (GRO) in water and soil. The compounds normally determined using this method are AK101 (n-hexane ( $C_6$ ) thru n-decane ( $C_{10}$ ) and NWTPH-Gx (n-hexane ( $C_6$ ) thru naphthalene). This method is applicable for the identification, by pattern matching and quantification of volatile petroleum products (those petroleum products for which the majority of components elute within the gasoline range). Current reporting limits can be found in TALS.

On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in the Quality Assurance Manual.

## 2.0 Summary of Method

This method provides chromatographic conditions for the detection of gasoline range hydrocarbons (GRO). Soil methanol extracts and water samples are analyzed using purge and trap introduction (Method 5030/5035) to a gas chromatograph. Detection is achieved using a Mass Spectrometer. Samples may be analyzed concurrently for BTEX or full list Volatiles (8260) using GCMS.

### 3.0 Definitions

Retention Time Standard: A standard containing n-Hexane and n-Decane in methanol. The retention time standard is analyzed every 24 hours or every 20 samples, whichever is less. This standard is used to establish the retention time window for quantitation of AK-GRO.

- **3.1** Gasoline Range Organics (GRO): All chromatographic peaks, both resolved and unresolved, eluting between the peak start time for n-hexane and the peak start time for n-decane for AK-GRO and benzene through Naphthalene for NWTPH-Gx. Quantitation is based on direct comparison of the baseline-baseline integrated area within this range to the total area of the calibration standard over the same range (C6-start C10 or C12), using GCMS response. Surrogate peaks shall be determined by valley-valley integration.
- **3.2** Analytical Batch: A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. Each group of 20 samples or less will all be handled as a separate batch.
- **3.3** Calibration Standard: Standards used to prepare the calibration curve. These standards are made by diluting the primary standard stock solution purchased from an ISO certified vendor. The calibration standard for gasoline is comprised of equal weights of regular, plus and premium grades of unleaded commercial gasoline products, diluted to the appropriate concentrations. Calibration standards may be prepared from neat materials or purchased from vendors.

- **3.4** Initial Calibration Verification (ICV): A standard run after the calibration to verify the accuracy of the initial calibration curve. These standards are made from a secondary source different than that used to make the calibration standard.
- **3.5** Continuing Calibration Verification (CCV): A standard run once every 10 samples to ensure the continuing validity of the initial calibration curve. This standard is made from the primary source used to produce the initial calibration standards. Each sequence is started and closed with a CCV.
- **3.6** Blank Spike (BS/BSD): A blank matrix that is spiked with a known amount of analytes. The recoveries of these analytes are measured against the true values and the percent difference is calculated. The laboratory control standard measures the accuracy of the analytical system. Also known as a laboratory control standard (LCS).
- **3.7** Surrogate: A control standard which functions as a quality control measure to evaluate system performance. A field surrogate can be used; a,a,a-Trifluorotoluene (a,a,a-TFT) is suggested. Compounds used as surrogates are toluene-d8, 4-bromofluorobenzene, and 1,2-dichloroethane-d4.
- **3.8** Method Blank (MB): An analytical control consisting of all reagents and surrogate standard which is carried through the entire analytical procedure. The method blank is used to define the level of laboratory background contamination.
- **3.9** Matrix Spike/Matrix Spike Duplicate (MS/MSD): If sufficient sample is available two aliquots of sample are spiked prior to sample extraction or digestion and analysis with the same known quantities of specific compounds are subjected to the analytical procedure. Percent recoveries are calculated for each compound and the relative percentage difference between the MS and MSD is used to evaluate analytical precision.
- **3.10** Sample Duplicate (DUP): Split samples taken either from the same sampling container or from another client-submitted container and analyzed separately with identical procedures. The analysis of the laboratory duplicates gives a measure of the precision associated with laboratory procedures.

### 4.0 Interferences

- **4.0** Contamination may occur when high level and low-level samples are sequentially analyzed. When a suspected high-level sample is analyzed, it should be followed by an analysis of reagent water (purge blank) to check for carryover contamination.
- **4.1** Sample injection line carryover contamination can be prevented by periodic rinsing of the sample injection lines with sequential washes of a mild solution of methanol and reagent water.
- **4.2** The trap and other parts of the purge and trap system are subject to contamination. Frequent trap bake out at 240°C for 12 minutes may be required to prevent this contamination.

- **4.3** Reagent water may become contaminated with low-level volatile organic compounds due to background laboratory contamination. Reagent water is purged with nitrogen for a minimum of 4 hours prior to use to minimize this interferent.
- **4.4** Samples can be contaminated by diffusion of volatile organics through the sample container septum during shipment and storage. A field sample blank prepared from reagent water and carried through sampling and subsequent storage and handling can serve to check for such contamination.
- **4.5** A number of low-level contaminants may be encountered. These include Benzene, Toluene, Ethylbenzene and Xylenes. Contamination sources may include breakdown of trap material, basic laboratory contamination (glassware, lab air, etc.) or the reagent water. These are monitored on a daily basis through the use of calibration and method blanks.
- **4.6** Some sources of purge and trap grade methanol have occasionally been shown to contain contaminant levels of the target analytes for this method. A methanol blank should be analyzed before using any new lot of methanol for client samples.
- **4.7** High levels of heavier petroleum products such as diesel or heating fuel may contain some volatile components producing a response within the retention time range for GRO. Other organic compounds, including chlorinated solvents, ketones, and ethers are also detectable by this method. As defined by the method, the GRO results include these compounds.

### 5.0 <u>Safety</u>

Employees must abide by the policies and procedures in the Corporate Safety Manual and Radiation Safety Manual and this document.

This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

## 5.1 Specific Safety Concerns or Requirements

Latex, Nitrile and vinyl gloves all provide adequate protection against the methanol used in this method.

The gas chromatograph contains zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.

There are areas of high voltage in both the gas chromatograph and the mass spectrometer. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

## 5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the SDS for each of the materials listed in the table. A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the SDS for each material before using it for the first time or when there are major changes to the SDS.

Material	Hazards	Exposure Limit (1)	Signs and symptoms of exposure	
Methanol (MeOH)	Flammable Poison Irritant	200 ppm- TWA	A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes.	
Various Standards	See MSDS in lab	See MSDS in lab	See MSDS in lab	
1 – Exposure limit refers to the OSHA regulatory exposure limit.				

### 6.0 Equipment and Supplies

### 6.1 <u>Instrumentation</u>

**6.1.1** Purge -and-Trap Sample Concentrator – OI Analytical Eclipse 4660 or equivalent

Recommended Purge and Trap Operating Parameters

	Method 1
Standby	40°C
Purge	10 minutes
Desorb	2 min @ 190 <b>º</b> C
Bake	9 min @ 210 <b>º</b> C
Auto Drain	On
Valve	110°C
Line	110°C
Mount	40°C

**6.1.2** Gas chromatograph – HP 5890 series II gas chromatograph with Enviroquant software or equivalent

Recommended Gas Chromatograph Operating Parameters

	HP 5890 series II Gas Chromatograph
Initial Temperature, °C	40
Initial Hold Time, min	1.00
Ramp 1, ºC/min	12.0

End Temperature, <sup>o</sup> C	130
Hold Time, min	0
Ramp 2, ºC/min	24.0
End Temperature, °C	220
Final Hold Time, min	6

- 6.1.3 <u>Mass Spectrometer</u> HP 5970/5971/5972/5973 or equivalent
- 6.1.4 OI model 5441-A Autosampler or equivalent
- **6.1.5** Data System: Hewlett Packard ChemStation for Windows 95 (version G1701AA)
- 6.1.6 Column: Restek Rtx VMS 60m, 0.25mm ID, 1.4um df or equivalent

## 6.2 <u>Supplies</u>

- OI Trap # 10 or equivalent
- Gas tight syringes (1, 10, 25, 50, 100, 250, and 1000 microliter), accurate to + 3%
- Luer lock syringes (5 milliliter), accurate to + 1%
- 2-2 Liter separatory funnels
- pH paper
- 40 mL VOA vials w/screw cap and Teflon septum
- 2 mL glass vial w/Teflon lined screw cap
- Fume hood
- Balance top loading w/ accuracy of + 0.01 g.
- Volumetric Flasks 50,100.

#### 7.0 Reagents and Standards

All neat standards/kits received are entered into TALs (LIMS). A standards label is printed and affixed to the bottle/kit. The life of an unopened flame sealed standard is set by the vendor for all purchased standards. All unopened standards are stored according to vendor recommendations. Opened/prepared standards have a life of 12 months and are stored in the freezer at -15°C.

The majority of the calibration standards are EPA certified, A2LA or second-source verified by the standard vendor in situations where suitable SRMs (Standard Reference Material) was available. For those compounds where standards must be made from neat material (due to instability) or some non-routine compounds, **where available**, a second-source is purchased and used to verify the standard.

Each time new standards are prepared and a new initial calibration is required, the standards are verified against a second-source ICV (Initial Calibration Verification) standard prior to any sample analysis. This holds for all routine compounds and those available as second-source material where available.

The methanol and sand lot numbers are also tracked in TALS.

- 7.1 Solvents
  - 1:1 HCI (Trace metal grade)
  - Purge & Trap Grade Methanol (MeOH)
  - Organic free water
  - Volatile Grade MeOH
- 7.2 <u>Miscellaneous</u>
  - stainless steel spatula
  - assorted amber and clear Teflon-lined screw-capped vials (1.5-2.0 mL, 3.5-5.0 mL)
  - cleaned 40 mL vials w/Teflon-lined screw-caps
  - assorted volumetrics (10 mL, 20 mL, 25 mL, 50 mL and 100 mL)

### 7.3 Spike Solutions and Intermediate Calibration Standards

**Note:** The volume, part number, concentration, and manufacturer of these standards may vary depending on stock on hand, changes by the standard vendor, required reporting limits, and availability.

# AK101/NWTPH-Gx/8260C Internal Standard/Surrogate Solution Soil and Water (SAM 1ul/5ml purge)

		<u>125-IS/125-</u>		
<u>10mL FV (in MeOH)</u>	<u>Final ppm:</u>	<u>Surrogate</u>		
(FV = Final Volume)				
<u>Standard</u>	<u>Volume</u> (mL)	Part #	Conc.	Manufacturer
			250-IS/250-	
			• · ·	<b>–</b> / /
VOA IS/Surr Mix	5.0	570812	Surr ug/mL	Restek

Retention Time Calibration           10mL FV (in MeOH)					
(FV = Final Volume) <u>Standard</u> Alaska retention time marker	<u>Volume</u> <u>(mL)</u> 0.1	<u>Part #</u> 30483	<u>Conc.</u> 1000 ug/mL	<u>Manufacturer</u> Restek	
	AK101 A	K Soil Surr	ogate		
250mL FV (in MeOH)	Final ppm: 2.4				
<u>Standard</u> a,a,a - Trifluorotoluene	<u>Volume</u> (mL) 0.06	<u>Part #</u> 30083	<u>Conc.</u> 10,000ug/mL	<u>Manufacturer</u> Restek	

Gasoline Calibration, Water & Soil Spike					
100mL FV (in MeOH)	Final ppm: 500				
<u>Standard</u>	<u>Volume</u> (mL)	Part #	<u>Conc.</u>	<u>Manufacturer</u>	
Gasoline composite mix	1.0	GCS-10X	50,000 ug/ml	Accustandard	
		Gasoline 2	<sup>nd</sup> Source		_
10mL FV (in Methanol)	Final p	opm: 495			
<u>Standard</u> Certified BTEX in Unleaded Gas Composite	<u>Volu</u>	<b>me (mL)</b> 0.9	<u>Part #</u> 30237	<u>Conc.</u> 5500	<u>Manufacturer</u> Restek

- **7.3.1** Initial Calibration Verification Standard 990ug/L: A second source is used to confirm the standards used for primary calibration of the instrument. 200uL of gasoline 2<sup>nd</sup> source is diluted to 100mL reagent water in a volumetric flask and transferred to a 40mL VOA vial.
- **7.3.2** Gasoline Calibration, Water & Soil Spike Solution, 500ug/mL: Used for initial and continuing calibrations, blank spikes, or matrix spikes. This is a 100x dilution of a commercial standard, purchased at 50,000ug/mL
- **7.3.3** Continuing Calibration Verification (CCV): 200uL of Gasoline Calibration Water & Soil Spike are diluted to 100mL reagent water in a volumetric flask and transferred to a 40mL VOA vial.
- **7.3.4** Soil/Water Internal Standard/Surrogate Standard Spiking Solution: See section 7.3 for the preparation of this standard. This standard is added to the SAM on the OI 4660 concentrator. The SAM injects 1ul of this standard into 5mL for purging, giving a final concentration of 25 ng/ml (surrogates) and 25 ng/ml (internal standards).
- **7.3.5** Retention Time Calibration (RTC): 43uL of 10ug/mL retention time calibration is spiked into 43mL reagent water. This standard is run prior to any initial calibration or AK101 analysis and used to update the gasoline range retention window.
- **7.4** All standards added to samples within a batch must be documented on the analytical bench sheet.

## 8.0 Calibration

**8.1** Before any instrument is used as a measurement device, the instrument response to known reference materials must be determined. The manner in which various instruments are calibrated depends on the particular type of instrument and its intended use. All sample measurements must be made within the calibration range of the instrument. Preparation of all reference materials used for calibration must be documented.

Calibration Controls	Sequence	Control Limit
Calibration Standards	5-point (minimum) linearity; lowest level at or below MRL	≤ 25% RSD for AK 101, $r^2$ ≥ 0.990 and no standard > ±15% of the true value for NWTPH-Gx
Initial Cal. Verif. (ICV)	After initial calibration	75-125% for AK101, 80- 120% for NWTPH-Gx
RT Windows (RTW)	Init. CCV determines midpt. of RTW for internal standards and surrogates Gasoline range is determined by a	± 3X SD
	retention time marker	

The calibration standards are prepared in 50mL volumetric flasks, inverted and transferred to 40mL VOAs for analysis. A sample calibration is in the table below:

## Gasoline Calibration – standard 7.3.2

Final Concentration (ug/L)	<u>Standard</u> <u>Conc.</u> (ug/mL)	<u>Standard</u> Amount (uL)	<u>Final</u> <u>Volume</u> (mL)
50	500	5	50
100	500	10	50
250	500	25	50
500	500	50	50
1000	500	100	50
2500	500	250	50
5000	500	500	50
10000	500	1000	50

## 2<sup>nd</sup> Source—standard 7.3.1

	<b>Standard</b>		<b>Final</b>
Final Concentration	Conc.	Standard	<u>Volume</u>
<u>(ug/L)</u>	<u>(ug/mL)</u>	Amount (uL)	<u>(mL)</u>
990	495	100	50

### 8.2 <u>Calibration curve corrective actions:</u>

- **8.2.1** In some cases, the high or low point is the problem; if there are no problems with the reporting limits or dynamic range one may elect to not consider one or both of these points.
- **8.2.2** Calibration points may be rejected because of non-linearity if they are the highest or lowest data points. Points within the curve may not be rejected without a means test or an analytical reason. The data for the rejected point must be included with initial calibration raw data with the reason for rejection documented.
- **8.2.3** If any other point is identified as an instrument issue it may be reanalyzed within 24 hours.
- **8.2.4** Perform maintenance (e.g. clean detectors, break off first three feet of column and reanalyze the entire curve).

## 9.0 Sample Collection, Preservation, Shipment and Storage

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time
Waters	40 mL	2 vials	HCl, pH < 2;	14 Days
	VOA with		Cool 4 <u>+</u> 2ºC	
	no			
	headspace			
Soils	pre-tarred	2 vials with 5	Cool 4 <u>+</u> 2ºC	14 Days
	40 mL	grams of soil.		
NVIPH	VUA			
-GX	preserved			
	with 5 mL			
	OT			
	Methanol			
Soils	4 oz.	25 grams	25 mL	14 Days BTEX,
	amber jar		surrogated	28 Days GRO
AK101	with		methanol <sup>1</sup> ;	(14 Days
	Teflon-		Cool 4 ± 2°C	unpreserved)
	lined cap			
	(pre-			
	tarred)			

<sup>1</sup> At the time of sample collection a 25 mL aliquot of purge and trap grade methanol containing 2.4  $\mu$ g/ml a,a,a-Trifluorotoluene is added to the soil. Soil must be submerged in the methanol and only swirled (not shaken).

## 10.0 <u>Quality Control</u>

**10.1** <u>Sample QC</u> - The following quality control samples are prepared with each batch of samples.

Quality Controls	Frequency	Control Limit
Method Blank (MB)	1 in 20 or fewer samples	< MRL
Laboratory Control Sample (LCS)	1 in 20 or fewer samples	80-120% for AK101, Statistical Limits <sup>4</sup> for NWTPH-Gx
LCS Duplicate (LCSD)	Required for Alaska methods	80-120% for AK101, Statistical Limits <sup>4</sup> for NWTPH-Gx
LCSD RPD	Required for Alaska methods	< 20% for AK101, Statistical Limits <sup>4</sup> for NWTPH-Gx
Matrix Spike (MS) <sup>1</sup>	optional	Statistical Limits <sup>4</sup>
MS Duplicate (MSD) <sup>1</sup>	optional	Statistical Limits <sup>4</sup>
MS/MSD RPD	optional	Statistical Limits <sup>4</sup>
Sample Duplicate (DUP) <sup>2</sup>	1 in 10 or fewer samples	Statistical Limits 4
Surrogates	Every QC sample <sup>3</sup>	60-120% for AK101, 50-150% for NWTPH-Gx
Surrogates	Every client sample	50-150% for AK101 and NWTPH-Gx

<sup>1</sup> A matrix spike and/or matrix spike duplicate are performed upon client request.

<sup>2</sup> Duplicate requirement is only for NWTPH-Gx soils.

<sup>3</sup> QC samples (MB, LCS/LCSD, MS/MSD)

<sup>4</sup> Statistical control limits are updated annually and are updated into LIMS.

- **10.1.1** If the method blank is greater than the limit, investigate the source of contamination. Re-prepare and reanalyze all associated samples. Exception: if the samples are non-detect or if the contaminant represents less than 5% of the concentration in client samples the data may be reported with qualification.
- 10.1.2 If the LCS recovery is outside the limit, check to be sure there are no errors in calculations and that the concentration of the analyte solution is correct. Check instrument performance to determine if it is within acceptable guidelines. Recalculate the data and/or reanalyze the extract if necessary. Re-prepare and reanalyze the samples if none of the above resolves the problem. Exception: if the BS/BSD fails high and the samples are non-detect the data may be reported with qualification.
- **10.1.3** If the MS or MSD recovery is greater than the limit, check to be sure there are no errors in calculations and that the concentration of the analyte solution is correct. Check instrument performance to determine if it is within acceptable guidelines. Recalculate the data and/or reanalyze the extract if any of the above checks reveals a problem. If none of the above resolves the problem and the LCS is acceptable, narrate as a possible matrix effect.

- **10.1.4** If the MS/MSD RPD is greater than the limit, check to be sure that there are no errors in calculations, and that the same amount and source of analyte solution, solvent and water were used for both samples in the set. If the MS/MSD percent recoveries were within limits, the RPD failure may be qualified.
- **10.1.5** If the Sample Duplicate RPD is greater than the limit, check to be sure that there are no errors in calculations, and that the same amount and source of analyte solution, solvent and water were used for both samples in the set. If the LCS is acceptable, narrate as a possible matrix effect.
- **10.1.6** If the Surrogate recovery is outside the limit, check to be sure there are no errors in calculations and that the concentrations of the surrogate and internal standard solutions are correct. Check instrument performance to determine if it is within acceptable guidelines. Recalculate the data and/or reanalyze the extract if any of the above checks reveals a problem. If the cause is evident from matrix type or chromatographic envelope showing hydrocarbon interference, the result may be qualified.
- **10.1.7** Refer to SP-QAG-012 for non-conformances and corrective action reports.
- **10.2** <u>Instrument QC</u> The following quality control samples are prepared with each batch of samples.

Step	Standards	Control Limit	Frequency	
Method AK	(101			
RTM	AK RTC	NA	Daily before analysis	
IBL	NA	< MRL	Daily before analysis	
ICV	GRO	75-125%	After initial cal	
CCV	GRO	75-125%	Beginning of run, every 20	
			samples, end of run	
Method NWTPH-Gx				
IBL	NA	< MRL	Daily before analysis	
ICV	GRO	80-120%	After initial cal	
CCV	GRO	80-120%	Beginning of run, every 20	
			samples, end of run	

- **10.2.1** If the ICV does not meet the acceptance criteria, re-prepare and re-analyze a new ICV standard from the stock. If the re-prepared standard does not meet the acceptance criteria, consult your supervisor.
- **10.2.2** If the CCV does not meet the acceptance criteria, re-prepare and reanalyze a new CCV standard from the stock. If the re-prepared standard does not meet the acceptance criteria, the initial calibration must be repeated.
- **10.2.3** If the instrument blank is greater than the limit, investigate the source of contamination, preferably before continuing the sequence. Re-prepare and reanalyze all associated samples.

## 11.0 <u>Procedure</u>

### 11.1 Sample Preparation

#### 11.1.1 Soil samples

**Note:** For batches that include AK101 samples, use methanol spiked with TFT at 2.4ug/mL (see. 7.3).

- **11.1.1.1** Method blanks are prepared by adding 5g of blank sand and 5mL methanol to a 40mL VOA vial.
- **11.1.1.2** LCS are prepared by adding 5g of blank sand and 4.5mL methanol to a 40mL VOA vial. The sand is then spiked with 500uL of gasoline spike (see 7.3.2).

Note: Alaska methods require LCS/LCSD for each batch.

- **11.1.1.3** Matrix spikes are prepared if a sufficient number of sample containers are provided. 86uL of gasoline spike is added directly to the 40mL VOA vial after 860uL of sample methanol has been added.
- **11.1.1.4** For NWTPH-Gx, prepare one sample duplicate for every 10 samples.
- **11.1.1.5** Prescreen samples using historical data, or a portable PID meter in order to estimate the existing contamination level and any required dilution. Batch samples into groups of not more than 20 samples each.
- **11.1.1.6** Before analysis, scan or hand-enter the tare weight for each sample into the appropriate cell in the TALs worksheet tab. Weight the sample container and record the value in the vial and sample column. Affix the TALs sample label to the container.
- **11.1.1.7** Enter "0" or "no" in the Correct for density column for containers that are pre-tared with methanol already added. Enter "1" or "yes" for samples that have methanol added in the field (i.e. Alaska samples).
- **11.1.1.8** In the case where the client has not collected soils preserved in methanol, prepare the soils as follows:
  - **11.1.1.8.1** Weigh out 5 g of each sample into a 40 mL vial. Record the actual weight in TALs.
  - **11.1.1.8.2** Add 5 mL of methanol.

- **11.1.1.8.3** Vortex each sample approximately 30 seconds or until the soil is completely broken up. Sonicate the samples for 1 minute. Centrifuge samples as needed.
- **11.1.1.9** To prepare a sample for analysis, fill an unused, unpreserved, labeled VOA vial to 43mL with purged reagent water. Remove 860µL of the water with a micropipette, then replace it with 860uL of the methanol sample extract. Cap and invert to mix.
- **11.1.10** If a dilution is necessary, dilute the extract directly into methanol and follow 10.1.1.9. Alternatively, add 860uL methanol to a final volume of 43mL in a VOA vial, then add a smaller sample extract aliquot with a syringe (e.g add 8.6uL sample methanol for a 100x dilution).
- **11.1.1.11** Surrogate/Internal Standard: The SAM injects both surrogate and internal standard into all samples and QC.
- **11.1.1.12** Load the VOA vials onto the autosampler.

#### 11.1.2 Water samples

- **11.1.2.1** To prepare the method blank, make a VOA vial containing 43 mL of reagent water.
- **11.1.2.2** LCS preparation: Add 100µL of the spike solution prepared in step **7.3.2** to a 50 ml volumetric with DI water. Cap and invert the volumetric one time slowly to insure the standard has been mixed thoroughly. Carefully pour this standard into a labeled 40 ml VOA vial and cap.

# Caution: Inverting the volumetric flask too much or too rapidly will cause the loss of volatile analyte into the headspace.

- **11.1.2.3** MS/MSD preparation: Add 86uL of the spike solution prepared in step 7.3.2, directly to the client sample VOA vial through the septa.
- **11.1.2.4** Prescreen samples using historical data, apparent odor of sample or a portable PID meter in order to estimate the existing contamination level and any necessary dilution.
- **11.1.2.5** Surrogate/Internal Standard: The SAM injects both surrogate and internal standard into all samples and QC.
- **11.1.2.6** Load the vials onto the autosampler for analysis.

#### 11.2 <u>Sample Analysis</u>

#### 11.2.1 Integrations

- **11.2.1.1** The integration for the alkane range is done by projecting a horizontal baseline over the appropriate range. Quantitation is forced to that baseline.
- **11.2.1.2** The surrogate quantitation is forced valley to valley.
- **11.2.1.3** Manual integrations must be performed in accordance with CA-Q-S-002.
- **11.2.1.4** GRO integrations are performed by GC software by taking the sum of small peaks between the start of n-hexane (C6) to the start of n-decane (C10) for AK 101 and n-hexane through naphthalene for NWTPH-Gx.

#### 11.2.2 Over range response

**11.2.2.1** Target analytes with responses greater than the highest level of the initial calibration must be re-analyzed at a dilution.

#### 11.2.3 Contingencies for Handling Out-of-Control or Unacceptable Data

- **11.2.3.1** Data that fails quality control requirements but cannot be repeated (e.g. insufficient sample volume or severe matrix effects) shall be brought to the immediate attention of the department manager or project manager so that results may be discussed with the client.
- **11.2.3.2** A narrative should accompany the analytical results explaining the analytical difficulties encountered in the analysis.
- **11.2.3.3** Anomalous situations occurring during sample preparation and analysis must be documented on the bench sheet, and non-conformance reports must be issued if necessary. Please see the SOP for Non-Conformances, SP-QAG-012. Possible anomalous situations resulting in non-conformance reports include loss of a sample or batch QC through spillage or breakage.

#### **11.2.4 Moisture Determination for Soils**

- **11.2.4.1** Since all results are reported on a dry-weight basis the percentage moisture must be determined. Thus a separate, unpreserved jar of the same sample must accompany the methanol-immersed sample.
- **11.2.4.2** Percentage moisture analysis will be done according to SP-SPL-003.

## 11.2.5 Water Miscible Solvent Effect

**11.2.5.1** All soil samples that are extracted prior to analysis in a water miscible solvent such as methanol are diluted by the total volume of the solvent/water mixture. The total mixture volume can only be calculated based on the sample moisture present as determined by the % moisture determination. See Sec. 11.10 and 11.11 for how the solvent/water dilution factor is determined and applied to the sample concentration calculation.

## 11.3 Data Review

- **11.3.1** Upon completion of the initial calibration run, the primary analyst acknowledges any TALS Data Review Checker (DRC) findings, add appropriate NCMs, and document the review on the data review checklist in TALS.
- **11.3.2** Upon completion of the analytical run, the primary analyst must review all data for compliance with criteria documented above, acknowledge any Data Review Checker (DRC) findings in TALS, and document the review on the data review checklist in DRC.
- **11.3.3** Upon completion of the primary review, the Department Supervisor (or designate) must perform a secondary peer review (see SP-QAG-023). The secondary reviewer completes the remaining items on the DRC checklist.

## 12.0 <u>Calculations / Data Reduction</u>

### 12.1 Relative Retention Time (RRT)

$$RRT = \frac{\text{Retentiontime of the analyte}}{\text{Retentiontime of the internals tandard}}$$

## 12.2 Response Factor (RF)

$$RF = \frac{A_s \times C_{is}}{A_{is} \times C_s}$$

Where:

 $A_s$  = Peak area (or height) of the analyte or surrogate  $A_{is}$  = Peak area (or height) of the internal standard  $C_s$  = Concentration of the analyte or surrogate  $C_{is}$  = Concentration of the internal standard

## 12.3 Standard Deviation (SD) and Relative Standard Deviation (RSD)

$$SD = \sqrt{\frac{\sum_{i=1}^{n} (RF_i - \overline{RF})^2}{n-1}} \qquad \qquad RSD = \frac{SD}{\overline{RF}} \times 100$$

Where:

 $\underline{RFi}$  = RF for each of the calibration standards RF = mean RF for each compound in the initial calibration n = Number of calibration standards, e.g., 5

## 12.4 Relative Percent Difference (RPD)

$$RPD = \frac{|Originalsamplevalue - Duplicatesamplevalue|}{[(Originalsamplevalue + Duplicatesamplevalue)/2]} \times 100$$

## 12.5 ICV, CCV, LCS Percent Recovery (%R)

 $\% R = \frac{Observed concentration}{Known concentration} \times 100$ 

#### 12.6 MS % Recovery (%R)

 $\% R = \frac{(Spiked sample concentration) - (Unspiked sample concentration)}{Spiked concentration} \times 100$ 

## 12.7 Internal Standard Response Factor (ISRF)

$$ISRF = \frac{A_x \times Q_{is}}{Q_x \times A_{is}}$$

Where:

 $\begin{array}{l} A_x = \mbox{Area response of analyte} \\ A_{is} = \mbox{Area response of internal standard} \\ Q_{is} = \mbox{Amount of internal standard} \\ Q_x = \mbox{Amount of analyte} \end{array}$ 

#### **12.8** Aqueous Sample Concentration (C)

$$C(mg/L) = \frac{A_x \times D}{RF \times V_s}$$

Where: C = Concentration of Analyte

RF = Response factor  $A_x$  = Response for the analyte in the sample, units in area  $V_s$  = Volume of sample purged, in liters D = Dilution factor, if dilution was performed on the sample prior to analysis. If no dilution was made, D = 1, dimensionless.

## 12.9 % Moisture

% Moisture= 
$$\frac{g \ of \ sample - g \ of \ dry \ sample}{g \ of \ sample} \times 100$$

## 12.10 Total solvent/water mixture volume in soil samples (Vt)

$$\mu L \, solvent / \, water V_t = \left[\frac{mL \, of \, solvent + (\% \, moisure \times g \, of \, sample)}{100}\right] \times 1000 \, \mu L / \, mL$$

## 12.11 Soil Sample Concentration, methanol extraction (C)

$$C(mg/kg) = \frac{A_x \times V_t \times D}{RF \times W \times V_t}$$

Where:

 $V_t$  = Total solvent/water mixture volume (µL) as defined above  $V_i$  = Volume of extract actually purged (µL) W = Weight of sample extracted, kg - the dry wet weight is used C, A<sub>x</sub>, RF, and D have the same definition as above

## 13.0 <u>Method Performance</u>

## 13.1 <u>Method Detection Limit Study (MDL)</u>

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure in the QA Manual. MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency or whenever there is a significant change in instrumentation or analytical methodology (see SP-QAG-010).

## 13.2 Demonstration of Capabilities

An initial demonstration of capability shall be performed before a new instrument or analytical method is brought into production.

Initial demonstrations of capability and annual demonstrations of capability or passing annual PE results are required for each analyst.

### 13.3 <u>Training Requirements</u>

See SP-QA-026 for general training requirements.

#### 14.0 <u>Pollution Control</u>

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability).

#### 15.0 <u>Waste Management</u>

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to SP-SPL-006. The following waste streams are produced when this method is carried out:

- VOA vials containing extracted acidic water and small amounts of methanol: neutralized, purged overnight and discharged down the drain.
- Aqueous acidic waste from sample analysis, which may contain small amounts of methanol: neutralized, purged overnight and discharged down the drain.

#### 16.0 <u>References / Cross-References</u>

- **16.1** TestAmerica Quality Assurance Manual
- **16.2** TestAmerica Health & Safety Manual
- **16.3** Volatile Petroleum Hydrocarbons Method for Soil and Water (NWTPH-Gx), Washington Department of Ecology.
- **16.4** Test Methods for Evaluating Solid Wastes, EPA SW-846, Method 8000C, rev. 2, December 1996.
- **16.5** Method AK101 For the Determination of Gasoline Range Organics. Version 4/08/02. State of Alaska.
- **16.6** SP-QAG-012, Non-Conformances : Data Qualifiers, NCRs, CARs, Case Narratives, and Root Cause Investigations
- **16.7** SP-QAG-010, Determining and Verifying Method Detection Limits (MDL) and Establishing Method Reporting Limits (MRL)
- **16.8** SP-QA-026, Basic Employee Training
- 16.9 SP-SPL-006, Sample Disposal

- 16.10 SP-QAG-023, Data Review and Reporting of Analytical Results
- **16.11** SP-SPL-003, Percent Solids
- **16.12** SP-FLS-012, Fridge Blanks
- 16.13 CA-Q-S-002, Acceptable Manual Integration Practices

## 17.0 <u>Method Modifications</u>

None

### 18.0 <u>Attachments</u>

None

### 19.0 <u>Revision History</u>

Revision 1: 12/30/05

Revision 2: 3/1/08

#### Reasons for Change, Revision 3:

- General Review & update for new autosampler:
  - Updated safety section
  - Removed Luer-lock syringes and gas-tight vials from supplies section
  - Added suggested instrument parameters
  - Updated the water spike standard prep
  - Updated the soil internal standard prep
  - Updated soil & water sample & QC prep
  - Added details about water miscible solvent correction
  - Updated calculations section
  - Updated references

Reasons for Change, Revision 4, dated 07/30/10:

Annual review

#### Reasons for Change, Revision 5, dated 07/24/12:

- Annual review
- Updated calibration table
- Updated the water/soil spike standard prep
- Updated the water/soil internal standard prep
- Updated soil & water sample & QC prep
- Combined AK101 and NWTPH-Gx
- Updated method to GCMS from FID
- Updated Attachment 1
- Added calibration checklist

#### Reasons for Change, Revision 6, dated 11/26/14:

- Annual review
- Updated Standards Lists
- Updated calibration table
- Updated Attachment 1

• Added file address

Reasons for Change, Revision 7, dated 12/15/2015:

- Updated Standards Lists
- Updated calibration table
- Updated Attachment 1
- Changed references for Element to TALS (LIMS)

## Reasons for Change, Revision 8, dated 12/27/2017:

- Updated Interferences
- Updated specific safety concerns
- Updated reagents and standards
- Updated spike solutions
- Updated calibration section.
- Updated instrument QC
- Updated procedure
- Updated standard amounts, table 7.3.2

Reasons for Change, Revision 9, dated 4/2/2019:

- Added calibration criteria for NWTPH-Gx
- Updated data review procedure
- Removed Attachment 1

Reasons for Change, Revision 10, dated 2/11/2020:

- Updated copyright information
- Updated approvers
- Updated standards part numbers and preparation
- Updated soil MS/MSD prep



Environment Testing TestAmerica

SOP No. SP-ORG-001, Rev. 11 Effective Date: 12/31/2019 Page No.: 1 of 18

# Measurement of Polychlorinated Biphenyls (PCBs) By Gas Chromatography and Electron Capture Detection (ECD)

## EPA 8082A/8082A-SV

	Approvals (Signature/Date):		
Terri Torres Quality Assurance Manager	Date	Randee Arrington Laboratory Director	Date

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Facility Distribution No. \_\_\_\_\_

Distributed To:
## 1.0 <u>Scope and Application</u>

## 1.1 Analytes, Matrix(s), and Reporting Limits

This method is used to determine polychlorinated biphenyls as Aroclors or as individual PCB congeners in extracts from water, soil and waste matrices. The analysis is performed on a capillary gas chromatograph equipped with an electron capture detector. The compounds normally determined by this lab using this method are found in the table below. Current reporting limits can be found in TALS.

Compound	CAS Number
Aroclor 1016	12674-11-2
Aroclor 1221	11104-28-2
Aroclor 1232	11141-16-5
Aroclor 1242	53469-21-9
Aroclor 1248	12672-29-6
Aroclor 1254	11097-69-1
Aroclor 1260	11096-82-5
Aroclor 1262	37324-23-5
Aroclor 1268	11100-14-4

On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in the Quality Assurance Manual.

#### 2.0 <u>Summary of Method</u>

The samples are prepared using the appropriate extraction and cleanup methods. The GC column is temperature programmed to separate the analytes, which are then detected with an electron capture detector.

## 3.0 <u>Definitions</u>

- **3.1** Analytical Batch: A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. Each group of 20 samples or less will all be handled as a separate batch.
- **3.2** Calibration Standard: Standards used to prepare the calibration curve. These standards are made by diluting the primary standard stock solution purchased from an ISO certified vendor.
- **3.3** Initial Calibration Verification (ICV): A standard run after the calibration to verify the accuracy of the initial calibration curve. These standards are made from a secondary source different than that used to make the calibration standard.
- **3.4** Continuing Calibration Verification (CCV): A standard run once every 10 samples to ensure the continuing validity of the initial calibration curve. This standard is made from the primary source used to produce the initial calibration standards. Each sequence is started and closed with continuing calibration verification standard.
- **3.5** Blank Spike (BS/BSD): A blank matrix that is spiked with a known amount of analytes. The recoveries of these analytes are measured against the true values and the percent

difference is calculated. The laboratory control standard measures the accuracy of the analytical system. Also known as a laboratory control standard (LCS).

- 3.6 Surrogate: A control standard which functions as quality control measures to evaluate system performance. Surrogate standards are added to all samples, method blanks, matrix spikes and calibration standards. Suggested surrogates are decachlorobipheyl (DCB) and tetrachloro-mxylene (TCX).
- **3.7** Method Blank (MB): An analytical control consisting of all reagents and surrogate standard which is carried through the entire analytical procedure. The method blank is used to define the level of laboratory background contamination.
- **3.8** Matrix Spike/Matrix Spike Duplicate (MS/MSD): Two aliquots of sample are spiked prior to sample extraction or digestion and analysis with the same known quantities of specific compounds are subjected to the analytical procedure. Percent recoveries are calculated for each compound and the relative percentage difference between the MS and MSD is used to evaluate analytical precision.
- **3.9** Internal Standards: Compounds used in the quantitation of target analytes. The compound used and required as the internal standard is 1-bromo-2-nitrobenzene. Internal standards are added to all samples, blanks, spikes, and calibration and check standards.

## 4.0 Interferences

- **4.1** Interferences can occur from a variety of sources such as glassware, reagents and dirty samples. These contaminants can result in qualitative and quantitative errors. The blank, samples and spikes must be evaluated for the source of interferences.
- **4.2** This laboratory analyzes a large amount of samples with complex dirty matrices. Non target compounds in these samples can cause poor column performance (e.g. decreased resolution and high baseline). To help alleviate this problem sample cleanup such as sulfuric acid, copper and florisil should be used. Sometimes sample cleanup does not solve the problem, therefore hexane blanks and heating the column to its maximum temperature between samples should be employed. Please review method 8000B section 3.0 and method 8082 section 3.0 for further information on this subject.
- **4.3** Interferences by phthalate esters introduced during sample preparation can pose a major problem in PCB determinations. To minimize this type of interference, avoid use and contact of plastic materials. These materials may be removed with sulfuric acid/permanganate cleanup.
- **4.4** Interference from DDT and it analogs (DDT, DDE and DDD). DDT and it analogs will respond to the detector and potentially interfere with the Aroclors as a co-elution. A standard of DDT analogs should be injected to determine which Aroclors if any are interfered with.

## 5.0 <u>Safety</u>

Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document.

This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

## 5.1 Specific Safety Concerns or Requirements

Methylene Chloride: consult SDS and the Chemical Hygiene Plan for proper handling and spill response.

Sulfuric Acid: Strong acid, all proper protective clothing should be worn.

## 5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the SDS for each of the materials listed in the table. A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the SDS for each material before using it for the first time or when there are major changes to the SDS.

Material	Hazards	Exposure Limit (1)	Signs and symptoms of exposure
Acetone (CH <sub>3</sub> ) <sub>2</sub> CO	Flammable Health Hazard	1000 ppm TWA	Extremely flammable liquid and vapor. Vapor may cause flash fire. Harmful if swallowed or inhaled. Causes irritation to skin, eyes and respiratory tract. Affects central nervous system.
Hexane CH <sub>3</sub> (CH <sub>2</sub> ) <sub>4</sub> CH <sub>3</sub>	Flammable	500 ppm TWA	Extremely flammable liquid and vapor. Vapor may cause flash fire. Harmful if swallowed or inhaled. Causes irritation to skin, eyes and respiratory tract. Affects the central and peripheral nervous systems.
Methylene Chloride (CH <sub>2</sub> Cl <sub>2</sub> )	Health Hazard	25 ppm TWA	Harmful if swallowed, inhaled, or absorbed through skin. Affects central nervous system, liver, cardiovascular system, and blood. Causes irritation to skin, eyes and respiratory tract. Suspect cancer hazard.
Sulfuric Acid (H <sub>2</sub> SO <sub>4</sub> )	Corrosive, Health Hazard	1 mg/m <sup>3</sup> TWA	Liquid and mist cause severe burns to all body tissue. May be fatal if swallowed or contacted with skin. Harmful if inhaled. Affects teeth. Cancer Hazard.
Various surrogate and calibration standards	See MSDS in lab	See MSDS in lab	See MSDS in lab
1 – Exposure lin	nit refers to the	OSHA regula	tory exposure limit.

## 6.0 Equipment and Supplies

## 6.1 Instrumentation

**6.1.1** Gas chromatography system:

Hewlett-Packard 5890 series II Gas Chromatograph

Injector, HP model# 18593B Tray, HP model# 18596B Controller, HP model# 18594B or equivalent

Suggested Gas Chromatographic Conditions:

Parameter	Setting
H <sub>2</sub> Carrier Gas Flow Rate	15 mL/min
Argon/Methane Makeup Gas Flow Rate	20 mL/min
Initial Temperature	120 °C
Hold 1	1 min
Ramp 1	11° C/min
End Temperature	330° C
Hold 2	2 min
Injector Temperature	250° C
Detector Temperature	310° C
Injection Volume	3 µL
Solvent	Hexane
Injector Type	Flash Vaporization
Detector Type	Dual ECD

## 6.1.2 GC Columns:

Restek *STX*-CLPesticides I, 30 m, 0.25 *m*m ID, 0.25  $\mu$ m df Restek *STX*-CLPesticides II, 30 m, 0.25 *m*m ID, 0.2  $\mu$ m df or equivalent

- **6.1.3** Data acquiring and analysis software: HP EnviroQuant Chemstation G1701AA, version 03.00
- 6.1.4 Laboratory reporting system: TALS
- 6.1.5 TALS/EnviroQuant interface: DataTool, version 1.01 or greater, Chrom

## 6.2 Supplies

- 6.2.1 Volumetric flasks: for standards preparation
- **6.2.2** Syringes: for standards preparation

## 7.0 <u>Reagents and Standards</u>

- **7.1** Stock Calibration Standards: The calibration standards are purchased in solution and certified by the manufacturer (Aroclor and PCB-1016/1260).
- 7.2 Calibration standard The working initial calibration standard consists of:

Compound	Concentration (ng/mL)
Aroclor 1016	2000
Aroclor 1260	2000
Decachlorobiphenyl (DCP)	160
Tetrachloro-meta-xylene (TCX)	160

Amount Added (µL)	Final Volume (µL)	Final Concentration 1016/1260 (µg/L)	Final Concentration DCP/TCX (µg/L)
500	500	2000	160
250	500	1000	80
125	500	500	40
50	500	200	16
12.5	500	50	4
5	500	20	0.08
2.5	500	10	0.04

From this standard, dilutions are made with hexane, as follows:

The 200 calibration point *can be* used to make three standards, as follows:

Amount Added (µL)	Final Volume (µL)	Final Concentration 1016/1260 (µg/L)	Final Concentration DCP/TCX (µg/L)
125	500	50	4
50	500	20	1.6
25	500	10	0.8

- **7.3** In addition a 500 µg/L standard (500ppb) of each of the remaining Aroclors (1221, 1232, 1242, 1248, 1254, 1262, 1268) is made for use when these are a suspect analyte.
  - **7.3.1** The Aroclor is purchased from a vendor at 1000 ppm and diluted to a stock standard of 5ppm by taking 0.025 mL of the stock solution and diluting to 5 mL with hexane. An additional intermediate standard is made by taking 50uL of this resulting stock solution and diluting it to 0.5mL for a resulting concentration of 500ug/L.
- **7.4** Surrogate standards: the surrogates for this method are DCP (primary) and TCX (secondary).
- **7.5** The decachlorobiphenyl and tetrachloro-meta-xylene are purchased certified from a vendor at 200 ppm (stock solution).
- **7.6** A 2ppm working solution is made by taking 1 mL of the stock solution into 100mL acetone.
- **7.7** Working standards are made for water and soil so when the surrogate is added to samples the amount of surrogate reaches 8µg/mL on instrument.
- **7.8** Matrix spike and laboratory control standards (spikes) are made from the same parent that is used to make the standards and CCV. Working standards are prepared from the 1000 ppm parent.100uL of intermediate is diluted to 10mL in acetone to create a 10000ug/L working standard.
- 7.9 Initial Calibration Verification (ICV): this stock solution of Aroclor-1016/1260 and PCB 1016/1260 is from a different source than was used to generate the curve and CCV. It is purchased certified from a vendor at 1000ppm. A 5ppm Stock is made by taking 25uL of this parent and diluting to 5mL with hexane. 200uL of this stock is diluted to 5mL in hexane to create a 200ug/L ICV working standard.

#### Note: all stocks and standards are stored according to manufacturer's instructions.

- **7.10** Internal Standard (IS): the internal standard (1-bromo-2-nitrobenzene) is purchased certified from a vendor at 1000ppm. The standard is diluted to a concentration of 250ppm by adding 500uL to a final volume of 2mL with hexane. The internal standard is then added to all analytical samples at a volume of 1uL to 500uL of sample.
- **7.11** Solvents used for extraction include n-hexane, methylene chloride and acetone and are purchased at pesticide quality or equivalent.
- **7.12** DDT analog standard. This standard is purchased certified form a vendor and diluted to a concentration of 100 ug/ml.

#### 8.0 <u>Sample Collection, Preservation, Shipment and Storage</u>

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container	Min. Sample Size	Preser vation	Holding Time	Reference
Waters	250mL Amber Glass	Full Volume 2000 mL, Small Volume samples 250mL	Cool 4 <u>+</u> 2°C	365 Days	N/A
Wipes	Gauze or PUF wipe	1 wipe	Store sealed at STP	365 Days	N/A
Soils	Glass Jar	250 grams	Cool 4 <u>+</u> 2°C	365 Days	N/A

Note: Sample extracts are stored at -10° C in the dark.

## 9.0 <u>Quality Control</u>

**9.1 Sample QC -** The following quality control samples are prepared with each batch of samples.

Quality Controls	Frequency	Control Limit
Method Blank (MB)	1 in 20 or fewer samples	< Rpt. Limit
Laboratory Control Sample (LCS)	1 in 20 or fewer samples	Statistical Limits 4
LCS Duplicate (LCSD) <sup>1</sup>	1 in 20 or fewer samples	Statistical Limits <sup>4</sup>
LCS/LCSD RPD	NA	Statistical Limits <sup>4</sup>
Matrix Spike (MS) <sup>2</sup>	1 in 20 or fewer samples	Statistical Limits 4
MS Duplicate (MSD) <sup>2</sup>	1 in 20 or fewer samples	Statistical Limits <sup>4</sup>
MS/MSD RPD	NA	Statistical Limits <sup>4</sup>
Surrogates	every sample <sup>3</sup>	Statistical Limits <sup>4</sup>

<sup>1</sup> LCS Duplicate (LCSD) is performed with each water batch and for soil batches only when insufficient sample is available for the MS/MSD or when requested by the client/project/contract.

<sup>2</sup> The sample selection for MS/MSD are randomly selected, unless specifically requested by a client.

<sup>3</sup> Analytical and QC samples (MB, LCS, MS/MSD)

<sup>4</sup> Statistical control limits are updated annually and are updated into LIMS.

- **9.1.1** The results of the method blank should be less than the MRL for that analyte or less than 5% of the regulatory limit associated with that analyte or less than 5% of the sample result for the same analyte, whichever is greater. If the method blank is greater than the limit, investigate the source of contamination. Re-prepare and reanalyze all associated samples. Exception: if the samples are non-detect the data may be reported with qualification.
- **9.1.2** If the LCS or LCSD recovery is outside the limit, check to be sure there are no errors in calculations and that the concentration of the analyte solution is correct. Check instrument performance to determine if it is within acceptable guidelines. Recalculate the data and/or reanalyze the extract if necessary. Re-prepare and reanalyze the samples if none of the above resolves the problem. Exception: if the BS/BSD fails high and the samples are non-detect the data may be reported with qualification.
- **9.1.3** If the LCS/LCSD RPD is greater than the limit, check to be sure that there are no errors in calculations, and that the same amount and source of analyte solution, solvent and water were used for both samples in the set. If the LCS/LCSD percent recoveries were within limits, the RPD failure may be qualified.
- **9.1.4** If the MS or MSD recovery is greater than the limit, check to be sure there are no errors in calculations and that the concentration of the analyte solution is correct. Check instrument performance to determine if it is within acceptable guidelines. Recalculate the data and/or reanalyze the extract if any of the above checks reveals a problem. If none of the above resolves the problem and the LCS is acceptable, narrate as a possible matrix effect.
- **9.1.5** If the MS/MSD RPD is greater than the limit, check to be sure that there are no errors in calculations, and that the same amount and source of analyte solution, solvent and water were used for both samples in the set. If the MS/MSD percent recoveries were within limits, the RPD failure may be qualified.
- **9.1.6** If the Surrogate recovery is outside the limit, check to be sure there are no errors in calculations and that the concentrations of the surrogate and internal standard solutions are correct. Check instrument performance to determine if it is within acceptable guidelines. Recalculate the data and/or reanalyze the extract if any of the above checks reveals a problem. If the cause is evident from matrix type or chromatographic envelope showing hydrocarbon interference, the result may be qualified.
- **9.1.7** Refer to SP-QAG-012 for non-conformances and corrective action reports.
  - **9.2 Instrument QC** The following quality control samples are prepared with each batch of samples.

	Step	Standards	Control Limit	Frequency
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CCV	Aroclor 1016/1260	80-120%	Beginning of 12-hour analysis period, every 20 samples, end of run
IBL	NA	< MRL	Before samples are run or when system contamination is suspected

- **9.2.1** The initial calibration must be verified by injecting at least one level with 1016 analyzed separately for pattern recognition purposes. This run does not need to be part of the actual calibration. The initial calibration must also be verified by injecting a Continuing Calibration Verification (CCV) 200ppb working standard containing Aroclor 1016 and 1260, IS and surrogates at the beginning of each 12 hour run. Update retention times on the first CCV of the day. If the response for the IS analyte is within 50-200% of the midpoint response of the initial calibration, and the analytes and surrogates are within ±20% then the calibration is still valid. The CCV must also pass a resolution check of 25% for the last three peaks of the 1260 Aroclor on one of the two columns used. In the case where one or more analytes exceeds 20%, the calibration is still valid if the average of the responses (or % drift) for all analytes is within 20%. If any of the analytes that exceeded 20% are reported, because the client cannot wait for a reanalysis of the sample, the data must be qualified and the % deviation noted. Samples are not required to be bracketed with successful CCVs (since internal standard is used).
  - **9.2.1.1** If the CCV does not meet the acceptance criteria, re-prepare and reanalyze a new CCV standard from the stock. All samples that were injected after the failed CCV should be re-injected to prevent misquantitation and possible false negative results. If the re-prepared standard does not meet the acceptance criteria, the initial calibration must be repeated.
- **9.2.2** Method blanks or solvent blanks may be used to check for contamination carryover from a high concentration sample into subsequent samples. If analytes from a high concentration sample are not present in the proceeding blank, then the lack of carryover has been demonstrated. If the instrument blank is greater than the limit, investigate the source of contamination, preferably before continuing the sequence. Re-prepare and reanalyze all associated samples.

## 10.0 <u>Procedure</u>

## **10.1 Sample Preparation**

Matrix	Method	SOP
Water	3510C	SP-EXT-006
Soil/Sediment	3550C	SP-EXT-001
Wipe	NA	SP-EXT-005
Waste	3580A	SP-EXT-011

**10.1.1** For specific sample preparation refer to the following:

Note: for water analysis, pH is checked prior to extraction and adjusted accordingly such that extraction occurs with a neutral sample pH of 5-9.

Cleanup	Method	SOP
Sulfur	3660B	SP-EXT-012
Sulfuric Acid	3665A	SP-EXT-002
Florisil	3620B	SP-EXT-009

**10.1.2** Extract cleanup: for further clean up of extract refer to the following:

## 10.2 Calibration

**10.2.1** Before any instrument is used as a measurement device, the instrument response to known reference materials must be determined. The manner in which various instruments are calibrated depends on the particular type of instrument and its intended use. All sample measurements must be made within the calibration range of the instrument. Preparation of all reference materials used for calibration must be documented.

Calibration Controls	Sequence	Control Limit	
Calibration Standards (Aroclor 1016/1260)	5-point (minimum) linearity	$\leq$ 20% RSD or r <sup>2</sup> ≥ 0.99 for linear regression force through zero	
Calibration Standard (Aroclor 1221, 1232, 1242, 1248, 1254)	1 point (as needed when one of these Aroclors is suspected)	NA	
Initial Cal. Verif. (ICV)	After initial calibration	80-120% Recovery	

## **10.2.2** Column priming

- **10.2.2.1** The column should be primed by injecting the working standard (section 7.2) on the column one or two times. This should be done before any standards are shot.
- **10.2.3** The calibration of the instrument involves analysis of a minimum of five different concentrations of the 1016/1260 standard prepared as describe in section 7.2. The lowest point is the reporting limit of the method. The calibration data files are then quantitated using Chrom in TALS. Then a five point calibration table for the 1016/1260 standard is generated by Chrom. The external standard method is used for this method. See EPA Method 8000B section 7 for more information.
- **10.2.4** In addition a 500ppb standard (see section 7.3) of Aroclor 1221, 1232, 1242, 1248 and 1254 are analyzed when they are a suspect analyte. A one point calibration for these Aroclors (1221, 1232, 1242, 1248, 1254) is generated by Chrom.
- **10.2.5** The calibration curve can be verified by either using the **average calibration factor** or linear regression force through zero. The use of the average calibration factor should be attempted first (see EPA Method 8000B 7.5.1 for equations and more details) and is set in Chrom as "Avg of Response Factors". If the relative standard deviation (RSD) is less than or equal to 20% than the curve may be used. In the case where one or more analytes exceeds 20% the curve is still valid if the mean of the RSD values for all analytes is less than or equal to 20%. If any of the

analytes that exceeded 20% are reported the data must be qualified and the % RSD noted. After the calibration has been verified then a "Response Factor Report" is generated and kept on file. If **linear regression** is used to verify the calibration (see EPA Method 8000B 7.5.2 for more details) the correlation coefficient (r) must be greater than or equal to 0.99 and is set in Chrom as "Linear regression". After the calibration has been verified then a curve for each analyte is printed and filed. The quadratic regression must be shown to not curve down, and if it does limits must be set on the range of response values that can be used for reporting.

- **10.2.6** The initial calibration will be verified by injection of a second source standard at 200ppb (see section 7.6) following the curve. The response for each analyte must be within  $\pm$  20% of the average response of the initial calibration for the calibration to be valid. In the case where one or more analytes exceeds 20%, the calibration is still valid if the average of the responses (or % drift) for all analytes is within 20%.
- **10.2.7** If the ICV does not meet the acceptance criteria, re-prepare and re-analyze a new ICV standard from the stock. If the re-prepared standard does not meet the acceptance critera, consult your supervisor.

## 10.3 Sample Analysis

- **10.3.1** Inject the sample extract into the gas chromatograph set to the appropriate conditions. If any analytes exceed the calibration range, a dilution must be made and reanalyzed.
- **10.3.2** If the standard analyzed **after** a group of samples exhibits a response for an analyte that is >20% and the analyte was **not** detected in the specific samples analyzed during that shift, then the extracts for those samples do not need to be reanalyzed (since the verification standard has demonstrated that the analyte would have been detected if present).
- **10.3.3** However, if an analyte was **not** detected in the sample and the standard response is more than 20% **below** the initial calibration response, then reinjection is necessary (to ensure the analyte could be detected despite the change in detector response).

## 10.3.4 Qualitative analysis

**10.3.4.1** For each sample a report is generated using the 1016/1260 method. If the suspected Aroclor pattern is not 1016/1260 then the sample is compared to the five remaining Aroclor standards and a report is generated using the Aroclor method that most closely resembles the pattern. Each of the Aroclor methods contains three to five standard congener peaks and these peaks should fall within a window of +/- 0.01 retention time units. Sometimes the presence of a non-analyte peak may show up within the retention time window.

## 10.3.5 Quantitative analysis

**10.3.5.1** The quantitation method calculates the concentration of five standard Aroclor peaks using the external standard technique (For details and

equations see EPA Method 8000B sec. 7.10.1). Three peaks, similar in concentration, are selected and averaged for the final concentration of that Aroclor.

## **10.3.6 Retention Time Window**

Retention time (RT) windows must be determined for all analytes.

- **10.3.6.1** Initial determination of Retention time windows.
- **10.3.6.2** The center of the retention time (RT) window shall be updated based on the middle level in the initial calibration or the first CCV in the daily analytical sequence, whichever is more recent.
- **10.3.6.3** Evaluate the deviation from expected retention time for each analyte in at least three CCV and/or LCS samples spread over at least 72 hours.
- **10.3.6.4** If three days of analytical data are not available, use a default RT window of 0.01 minutes. At the end of the batch evaluate all CCVs and LCS in the batch. If necessary, widen the window such that all analytes fall within the RT window. Reprocess the batch using the new RT windows.
- 10.3.6.5 Multiply the maximum deviation by 1.5. This is the retention time window, unless the result is less than 0.01 min, in which case the window is set at 0.01 min. For example, if the maximum RT deviation for a specific analyte is 0.008 min, then the RT window is set at +/- 0.012 min. This default of 0.01 min is specifically for GC GCMS should be a bit wider and LC may need to be much wider

**NOTE:** For the multi-component analytes, for example Aroclors, Toxaphene and Technical Chlordane, the maximum deviation must be evaluated for each of the 3 to 6 major peaks used for sample calculations.

- **10.3.6.6** Retention time windows for analytes of interest must not overlap. For GC; they may overlap for GCMS.
- **10.3.6.7** Ongoing evaluation of retention time windows
- **10.3.6.8** Evaluate the retention time windows on an ongoing basis. The center of the RT window is updated on the first CCV of the day. All analytes for all subsequent CCVs, LCS and matrix spikes must fall within the retention time window (except as discussed below). Retention time update standard for certain method.
- **10.3.6.9** Matrix spike analytes may fall outside the retention time window if there is a large non-target peak coeluting with the analyte in the matrix spike.
- 10.3.6.10 If any analytes fall outside the retention time window in CCVs, LCS or matrix spikes (except as discussed above for matrix spikes) then the RT windows for those analytes shall be widened to the minimum degree required for the analyte to fall within the RT window. All samples in the batch shall be reprocessed with the new RT window, and the wider RT window shall remain in place for subsequent batches.
- **10.3.6.11** Retention time windows should be reliably narrower than +/- 0.03 min. If RT windows wider than this are necessary, the instrument should be

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evaluated and maintenance performed as needed. Subsequent to maintenance, RT windows shall be narrowed to the extent that is consistent with the data obtained.

## 11.0 <u>Calculations / Data Reduction</u>

## 11.1 Accuracy

ICV / CCV, LCS % Recovery = <u>observed concentration</u> x 100 known concentration

MS % Recovery = <u>(spiked sample) - (unspiked sample)</u> x 100 spiked concentration

## 11.2 Precision (RPD)

Matrix Duplicate (MD) = <u>|orig. sample value - dup. sample value|</u> x 100 [(orig. sample value + dup. sample value)/2]

**11.3** Concentration = mg/kg or L =  $\underline{C \times V \times D}$ 

Where:

C = sample concentration in extract (ppm)

V = Volume of extract (mL)

D = Dilution Factor

W = Weight/Volume of sample aliquot extracted (grams or mLs)

## 11.4 Dry Weights

**11.4.1** All dry weight corrections are made in TALS at the time the final report is prepared. To determine the dry weight of a sample, refer to SP-SPL-003.

## 11.5 Data Review

- **11.5.1** Upon completion of the initial calibration run, the primary analyst acknowledge any TALS Data Review Checker (DRC) findings, add appropriate NCMs, and document the review on the data review checklist in TALS.
- **11.5.2** Upon completion of the analytical run, the primary analyst must review all data for compliance, acknowledge any TALS Data Review Checker (DRC) findings, add appropriate NCMs, and document the review on the data review checklist in TALS.
- **11.5.3** Upon completion of the primary review, the Department Supervisor (or designate) must perform a secondary peer review (see SP-QAG-023). The secondary reviewer reviews the data review checklist (DRC) in TALS.

## 12.0 Maintenance Guide for GC/MS systems

See Attachment 1: Semivolatile GC Maintenance

## 13.0 <u>Method Performance</u>

## 13.1 Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure in Section 20.7 of the QA Manual. MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency or whenever there is a significant change in instrumentation or analytical methodology (see SP-QAG-028).

## **13.2** Demonstration of Capabilities

An initial demonstration of capability shall be performed before a new instrument or analytical method is brought into production.

Initial demonstrations of capability and annual demonstrations of capability or passing annual PE results are required for each analyst.

## **13.3 Training Requirements**

See SP-QAG-026 for general training requirements.

## 14.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability).

#### 15.0 <u>Waste Management</u>

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to SP-SPL-006.

#### 16.0 <u>References / Cross-References</u>

- **16.1** TA Quality Assurance Manual
- **16.2** TA Health & Safety Manual
- **16.3** Test Methods for Evaluating Solid Wastes, EPA SW-846, Method 8000C, rev. 3, March 2003.
- **16.4** Test Methods for Evaluating Solid Wastes, EPA SW-846, Method 8082A, rev. 6, February 2007. "Polychlorinated Biphenyls (PCBs) by Gas Chromatography."

- **16.5** SP-QAG-028, Method Detection Limit Studies, Limits of Detection, Reporting Limits and Limits of Quantitation
- **16.6** SP-QAG-026, Basic Employee Training
- 16.7 SP-SPL-006, Sample Disposal
- 16.8 SP-QAG-023, Data Review and Reporting of Analytical Results
- 16.9 SP-EXT-006, Preparation of Liquids for Semivolatile Analysis by EPA 3510C
- 16.10 SP-EXT-001, Preparation of Solids and Soils for Semivolatile Analysis by EPA 3550C
- 16.11 SP-EXT-002, PCB Acid Cleanup
- 16.12 SP-EXT-009, Florisil Cleanup
- 16.13 SP-EXT-005, Preparation of Wipes for PCB Analysis by 8082A
- 16.14 SP-EXT-011, Waste Dilution by EPA 3580A
- 16.15 SP-EXT-012, Sulfur Cleanup by EPA 3660B
- **16.16** SP-SPL-003, Determination of Percent Solids

## 17.0 <u>Method Modifications</u>

ltem	Method 8082	Modification
1	2.5	Sample injection volume is 3 $\mu$ L, not 2 $\mu$ L as the method recommends.

### 18.0 <u>Attachments</u>

**18.1** Attachment 1: Semivolatile GC Maintenance

## 19.0 <u>Revision History</u>

Revision 2, dated December 30, 2005

## Revision 3, dated January 15, 2007

Reasons for change, Revision 4, dated 03/15/2010

- Update method from 8082 to 8082A
- Annual review

## Reasons for change, Revision 5, dated 03/20/2012

- Changed solvent used to prepare spike mix from hexane to acetone
- Allow quadratic regression for quantitation, added information on validity of quadratic curves.

Reasons for change, Revision 6, dated 03/28/2014

• Updated calibration preparation sections to reflect current practice

## Revision 07, dated 12/5/2014

- Added reference to AK small volume samples.
- Added file address
- Added new QAM signature

## Revision 08, dated 1/5/2016

- Added internal standard and acceptance requirements
- Added TALS and Chrom references
- Added corporate checklists for data review

## Revision 09, dated 06/21/2016

• Added retention time window implementation (section 10.3.6)

## Revision 10, dated 09/6/2017

- Added Maintenance Section, 12.0
- Updated Attachment 2 to include routine maintenance.
- <u>Removed Attachment 1</u>
- Updated section 11.5 for data review checker (DRC)
- Updated reference from 8000B to 8000C, section 16.3
- Corrected reference, section 16.5

Revision 11, dated 12/27/2019

Updated Calibration points and concentrations to reflect current practices

## Attachment 1. Semivolatile GC Maintenance

## Daily Maintenance Checklist

- Replace injector septa daily for each inlet depending on sample load.
- Refill solvent rinse vials and empty solvent waste vials.
- All gas cylinders are checked and changed if the pressure is less than 500 psi.

## **Routine Instrument Maintenance**

The following activities constitute routine maintenance procedures and are performed either Mondays and Thursdays, or as necessary.

- Clip Column;
- Install new injection port liner;
- Install new septum;
- Install new gold seal and washer, or equivalent;

## Injector port maintenance is performed whenever the following conditions exist:

- High column bleed
- Peak broadening and/or tailing for polar analytes such as phenols
- Loss of sensitivity
- Calibration failures due to a loss of response
- Retention time drift
- Long or training solvent tail
- Overall loss of instrument response

Clean the inside of the injector body with a cotton swab dipped in hexane. Allow to air dry, and then replace the liner with a new or reconditioned liner that has been solvent rinsed, and muffled at 400 $^{\circ}$ C. re-pack the glasswool in the re-conditio ned liner, replace the septum and tighten the nut just past finger tight.

If column clipping is required, cool the inlet down to 45°C. Using a ceramic column cutter, remove at least 4 cm of the column end, depending on the severity of the system contamination. Place a column nut and new ferrule over the end of the column and re-cut one inch from the column end to ensure that no ferrule fragments remain in the column. Feed the column into the tapered liner until seated, then hold pressure on the column while the nut is tightened to one turn past finger tight. At this point, the GC inlet is brought up to operating temperature. The system should then be leak checked.

## Detectors

- Columns are removed, cut and re-inserted.
- ECD's are wipe tested yearly.

## Parts List

• Vespel/Graphite compact ferrules 0.8mm ID (Restek 20263), 0.5mm ID (Restek 20248), 0.4mm ID (Restek 20238).

- Injector Septa, 11mm diameter (Restek 20364)
- Glass Inlets: 2mm ID Goosneck Splitless (Restek 20796), 4mm Splitless sleeve w/FS Wool
  (Restek 202401), 2mm ID Splitless Quarter (Restek 20045)
- (Restek 22401), 2mm ID Splitless-Quartz (Restek 20915).
- Viton o-rings (Restek 20377)
- Gold Seals (Restek 21317)

- Wipe Test Kit
- Column cutter (Crystal and Ceramic)
- Flow measurement device
- GC tools and wrenches
- Snoop leak detection liquidGas Purifier (Supelco OM-1)



Environment Testing TestAmerica

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# Measurement of Polynuclear Aromatic Hydrocarbons (PAHs) By Gas Chromatography/Mass Spectrometry in Selective Ion Monitoring (SIM) Mode Methods 8270D/8270D-SV and 8270E/8270E-SV

	Approvals (Signature/Date):		
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## 1.0 Scope and Application

## 1.1 Analytes, Matrix(s), and Reporting Limits

This method is used to determine PAHs in a variety of waste matrices, soils, air sampling media and water samples. This SOP is (1) applicable to analyses required by the Office of Solid Waste (OSW), and (2) based upon the guidelines established in SW 846, Revision III. Current reporting limits may be found in LIMS.

On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in the Quality Assurance Manual.

#### 2.0 <u>Summary of Method</u>

PAHs are quantitatively measured utilizing a gas chromatograph/mass spectrometer (GC/MS) system. Sample introduction is via an auto-sampler system in conjunction with the gas chromatograph. Identification of target analytes is accomplished by relative retention time (RRT) and mass spectra comparison in SIM mode, to known standards. Quantitation is based upon target analyte response relative to an internal standard utilizing a five point (or greater) calibration curve. This method is restricted to use by, or under the supervision of, analysts experienced in the use of GC/MS and skilled in the interpretation of mass spectra.

#### 3.0 <u>Definitions</u>

- **3.1** Primary Stock Solution(s): Singular or standard combinations prepared with known concentration and purity. These standards are purchased from an ISO certified vendor and require documentation as to concentration, purity, and traceability.
- **3.2** Calibration Standards: Standards used to prepare and document the initial calibration curve. These standards are prepared by diluting primary stock solutions as specified in Section 7.0.
- **3.3** Calibration Check Standard: A standard run immediately after the initial calibration curve to verify accuracy. This standard should be acquired from a source other than that of the primary stock solution. At a minimum, the standard must be from a different lot number than that of the standards used for initial calibration. Documentation as to concentration, purity, and traceability is required. This is also referred to as the Initial Calibration Verification (ICV).
- **3.4** Daily Calibration Check Standard: A standard run once every 12 hours (at a minimum) to verify validity of the initial calibration curve. This standard is made from the source supplying the primary stock solutions.
- **3.5** Calibration Check Compound (CCC): Compounds used to evaluate calibration integrity. All of the PAHs are used to verify the integrity of the system.
- **3.6** Surrogate Standards: Compounds used to evaluate extraction efficiency. Compounds used as surrogates are nitrobenzene-d5, 2-fluorobiphenyl, and p-terphenyl-d14. Surrogate percent recovery is monitored to assess method performance on the

particular matrix. Surrogates are added to all samples, blanks, and spikes prior to extraction. Surrogates are also added to all calibration and check standards.

- **3.7** Internal Standards: Compounds used in the quantitation of target analytes. Compounds used as internal standards are naphthalene-d8, acenaphthene-d10, phenanthrene-d10, chrysene-d12, and perylene-d12. Internal standards are added to all samples, blanks, spikes, and calibration and check standards.
- **3.8** Laboratory Control Sample (Fortified Blank or Blank Spike): A blank matrix spiked with known analytes at a known concentration. The laboratory control sample (LCS) is used to calculate method accuracy and/or bias by comparing the calculated value to the known value.
- **3.9** Method Blank: A control sample, consisting of a clean matrix with all reagents and standards, which is carried through the entire analytical procedure. The method blank is used to document the presence/absence of laboratory induced contamination.
- **3.10** Instrument Blank: A control sample consisting of a clean matrix which is carried through the entire instrumental procedure. The instrument blank is used to document the presence/absence of instrument induced contamination.
- **3.11** Matrix Spike/Matrix Spike Duplicate (MS/MSD): A field sample that is spiked with known analytes at known concentrations. The MS/MSD is used to document analytical precision.

## 4.0 <u>Interferences</u>

- **4.1 Special Treatment -** The following analytes may require special treatment in conjunction with this analytical method:
- **4.1.1** Pentachlorophenol is subject to erratic chromatographic behavior. This situation is compounded if the system is contaminated with high boiling material(s).
- **4.1.2** Pyridine may perform poorly at elevated injection port temperatures. Lowering the injection port temperature may reduce the amount of degradation although this should be done with caution as it may affect the performance of other analytes.

## 4.2 Carryover

**4.2.1** Carryover may occur when samples containing high concentrations of semivolatile organic compounds are analyzed within a batch. If sample concentration has historically been high or is suspected to contain high analyte concentrations, screening or dilution is recommended prior to analysis. If instrument carryover is suspected, an instrument blank should be processed to verify instrument cleanliness.

#### 5.0 <u>Safety</u>

Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document.

This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

## 5.1 Specific Safety Concerns or Requirements

Various acids and chemicals used in this procedure are considered hazardous and may present a health hazard. Trained personnel should do all work under a hood. Laboratory personnel must wear safety glasses, and protective gloves and clothing throughout the preparation process.

## 5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the SDS for each of the materials listed in the table. A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the SDS for each material before using it for the first time or when there are major changes to the SDS.

Material	Hazards	Exposure Limit (1)	Signs and symptoms of exposure
Acetone	Flammable, Health Hazard	1000 ppm TWA	Extremely flammable liquid and vapor. Vapor may cause flash fire. Harmful if swallowed or inhaled. Causes irritation to skin, eyes and respiratory tract. Affects central nervous system.
Methylene Chloride (CH <sub>2</sub> Cl <sub>2</sub> )	Health Hazard	25 ppm TWA	Harmful if swallowed, inhaled, or absorbed through skin. Affects central nervous system, liver, cardiovascular system, and blood. Causes irritation to skin, eyes and respiratory tract. Suspect cancer hazard.
Various surrogate and spike standards	See MSDS in lab	See MSDS in lab	See MSDS in lab
1 – Exposure I	imit refers to the	e OSHA regulato	pry exposure limit.

## 6.0 Equipment and Supplies

#### 6.1 Instrumentation

- **6.1.1** Gas Chromatograph: Analytical systems complete with a temperature programmable chromatograph and the appropriate interface for sample introduction. The system includes all required accessories including syringes, columns, and gases.
- 6.1.2 Suggested Operating Conditions and Equipment
- 6.1.2.1 Column: 30m x 0.25mm ID x 0.5 film thickness

Setting	Suggested Rate
Injector Temp	280°C
Transfer Line Temp	280°C
Helium Carrier Flow	1 mL/min @ 80℃
Initial Temp	100℃
Hold	0.5 min
Ramp 1	20℃/min
End Temp	250℃
Ramp 2	8℃/min
End Temp	290℃
Ramp 3	25℃/min
End Temp	330°C
Final Hold	7.4 min
Injector Temp	25 mL/min
Air Flow at Detector	100-300 mL/min

## 6.1.2.2 Guard Column: 10 m associated with the column

- 6.1.3 Mass Spectrometer
- 6.1.4 Data System
- **6.1.4.1** A computer system that allows continual acquisition and storage of all mass spectra obtained during the analytical process. The computer must have software that allows searching of any MS data file for specific ion masses and allows plotting of ion abundance versus time or scan numbers (Extracted Ion Current Profile).

## 6.2 Supplies

- 6.2.1 Balance capable of weighing 0.0001g
- 6.2.2 Syringe(s)
- 6.2.3 Class A volumetric glassware w/ground glass stoppers

## 7.0 <u>Reagents and Standards</u>

- 7.1 Reagent grade (or better) organic chemicals: methylene chloride, acetone.
- 7.2 Organic free reagent water
- 7.3 <u>Stock standard solutions for Calibration (concentrations vary by analyte)</u>
- **7.3.1** Standard base/neutral solutions are purchased as certified solutions at 2000 and 1000 ppm and surrogates at 5000 ppm. Dilutions of the stock standard solutions are made for a final working concentration of 40 ppm and include the surrogates. The working 40 ppm standard is used to make the calibration curve at 20, 10, 4, 2, 0.4, 0.16 and 0.08 μg/mL (ppm). They are each spiked with internal standard prior to analysis.

**7.3.2** This standard is diluted 20x in methylene chloride to make the upper calibration level for small volume waters at 2,000ug/L. This standard is used to make a calibration that ranges from 5ug/l to 2,000ug/l.

## 7.4 Internal standard solution

- **7.4.1** Stock Standard Solutions: Acenaphthene-d10, Chrysene-d12, Naphthalene-d8, Perylene-d12 and Phenanthrene-d10 are purchased from a vendor at 2000 mg/L (ppm).
- **7.4.2** Working Standard: The stock solution is diluted 2x with methylene chloride. 1uL is added to each 500uL aliquot of extract/standard prior to injection so that the final concentrations of the internal standard compounds is 2ng/uL. For small volume waters, a second working solution is made at 20x of the stock so that the final concentration is 0.2ng/uL.

## 7.5 <u>Surrogate standard solution</u>

- **7.5.1** Surrogate stock standard solution: Standards (2-fluorobiphenol, p-terphenyld14, and nitrobenzene-d5) purchased at a concentration of 5,000 ng/µL.
- **7.5.2** Working standard solution: Base/neutral surrogates at 500 ng/μL by taking 1 mL of the surrogate stock solution and diluting to 10 mL with acetone or methanol. 20μL of this surrogate is added to each sample with a 2mL final volume for a final concentration of 5 ng/μL. For small volume waters, a 4,000ng/mL working surrogate is made in acetone or methanol so that the final concentration in the extract should be 200ug/L when 100uL is spiked.

#### 7.6 Matrix spike standard solution

- **7.6.1** Spike solution contains all of the PAHs. Pentachlorophenol is spiked as a second spike on client request.
- **7.6.2** Spike standards should be prepared from the same standards that are used as primary calibration stock.
- **7.6.2.1** An example of preparation would involve taking 0.25 mL of a purchased 2000 ppm base/neutral standard mix and diluting it to 5 mL with methylene chloride. Final concentration should be 100 ng/μL (ppm).
- 7.6.3 Additional compounds may be added based upon project specifications.
- **7.6.4** The matrix spike standard should also be used for the laboratory control/control duplicate samples.
- **7.6.5** Spiking solutions should be prepared at a concentration of 100 ng/µL.
- 7.7 <u>Second Source Standard Solution</u>
- 7.7.1 A final 40ppm second source standard used for the ICV is made by taking\_0.1 mL of

the base/neutral standard stock purchased at 2000ppm and 0.4 mL of pentachlorophenol stock of 1000ppm and surrogates 0.2mL of a 1000ppm solution and dilute these together to 5 mL with methylene chloride.

#### 8.0 Sample Collection, Preservation, Shipment and Storage

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

	Sample	Min. Sample Size	-		
Matrix	Container		Preserva tion	Holding Time	Reference
Waters	Amber glass	Full Volume 2-1 L, Small Volume AK samples 250mL	Cool 4 <u>+</u> 2°C	7 Days; 40 Days for extracts <sup>1</sup>	NA
Soils	4 oz. Glass jar	250 g	Cool 4 <u>+</u> 2°C	14 Days; 40 Days for extracts <sup>1</sup>	NA

<sup>1</sup> Extracts must be sealed and stored at  $\geq > -10^{\circ}$ C with unpierced PTFE-lined septa and protected from light.

#### 9.0 **Quality Control**

9.1 Sample QC - The following quality control samples are prepared with each batch of samples.

Quality Controls	Frequency	Control Limit
Method Blank (MB)	1 in 20 or fewer samples	< MRL
Laboratory Control Sample (LCS)	1 in 20 or fewer samples	Statistical Limits <sup>4</sup>
LCS Duplicate (LCSD) <sup>1</sup>	1 in 20 or fewer samples	Statistical Limits <sup>4</sup>
Matrix Spike (MS) <sup>2</sup>	1 in 20 or fewer samples	Statistical Limits <sup>4</sup>
MS Duplicate (MSD) <sup>2</sup>	1 in 20 or fewer samples	Statistical Limits <sup>4</sup>
Sample Duplicate (DUP) <sup>1</sup>	1 in 20 or fewer samples	Statistical Limits <sup>4</sup>
Surrogates	every sample <sup>3</sup>	Statistical Limits <sup>4</sup>
Internal Standards	every sample <sup>3</sup>	Area counts $-50\%$ to $+200\%$ ; retention time $\pm$ 30 seconds of the 12 hour standard

<sup>1</sup> LCS Duplicate (LCSD) or Sample Duplicate (DUP) is performed only when insufficient sample is available for the MS/MSD or when requested by the client/project/contract.<sup>2</sup> The sample selection for MS/MSD are randomly selected, unless specifically requested by a client....predetermined by

<sup>3</sup> Analytical and QC samples (MB, LCS, MS/MSD)

<sup>4</sup> Statistical control limits are updated annually and are updated into LIMS.

- 9.1.1 If contamination in the method blank is greater than the limit, investigate the source of contamination. Re-prepare and reanalyze all associated samples. Exceptions when the data may be reported with qualification:
- 9.1.1.1 If the samples are non-detect.
- 9.1.1.2 If the contamination is < 5 times the concentration found in the sample(s).

the extraction lab.

- **9.1.1.3** If the contamination is < 5% of the regulatory limit associated with the analyte.
- **9.1.1.4** If the contamination is associated with common laboratory contaminates and is < 10 times the concentration found in the sample(s).
- **9.1.1.5** If blank contamination is detected and samples cannot be reprocessed, the blank and all associated samples must be flagged for blank contamination.
- **9.1.1.6** Blank subtraction must not be applied as a correction to sample analysis.
- **9.1.2** If the LCS recovery is outside the limit, check to be sure there are no errors in calculations and that the concentration of the analyte solution is correct. Check instrument performance to determine if it is within acceptable guidelines. Recalculate the data and/or reanalyze the extract if necessary. Re-prepare and reanalyze the samples if none of the above resolves the problem. Exception: if the LCS fails high and the samples are non-detect the data may be reported with qualification.
- **9.1.3** If the LCS/LCSD RPD is greater than the limit, check to be sure that there are no errors in calculations, and that the same amount and source of analyte solution, solvent and water were used for both samples in the set. If the LCS/LCSD percent recoveries were within limits, the RPD failure may be qualified.
- **9.1.4** If the MS or MSD recovery is greater than the limit, check to be sure there are no errors in calculations and that the concentration of the analyte solution is correct. Check instrument performance to determine if it is within acceptable guidelines. Recalculate the data and/or reanalyze the extract if any of the above checks reveals a problem. If none of the above resolves the problem and the LCS is acceptable, narrate as a possible matrix effect.
- **9.1.5** If the MS/MSD RPD is greater than the limit, check for sample related reasons, i.e., large dilutions or high levels of target or non-target analytes. If a clear reason exists for the failing parameter, initiate a non-conformance memo (NCM) and flag the data. If no reasonable explanation exists, re-analyze the MS/MSD. If it still fails, flag the data and initiate a NCM detailing that the blank spike passed and the failing MS/MSD may be sample-matrix related.
- **9.1.6** If the Sample Duplicate RPD is greater than the limit, check to be sure that there are no errors in calculations, and that the same amount and source of analyte solution, solvent and water were used for both samples in the set. If the LCS is acceptable, narrate as a possible matrix effect.
- **9.1.7** If the %R of a surrogate in the method blank fails, corrective action must be taken. Check the internal standard and surrogate spiking solutions for degradation or contamination and the instrument performance. If these steps fail to reveal a problem, reanalyze the blank. Finally, re-extract and reanalyze the blank, blank spike and all associated samples if none of the above actions solve the problem. Sample analysis cannot continue until a passing method blank is analyzed.

- **9.1.8** For samples, up to one surrogate in each fraction is allowed to be outside of established limits before corrective action is required. When more than one surrogate in each fraction is out of limits, take the following corrective actions:
- **9.1.8.1** Check calculations to assure there are no errors; check internal standard and surrogate spiking solutions for degradation, contamination, etc.; check instrument performance, and blank surrogate recoveries.
- **9.1.8.2** Reanalyze the sample if these steps fail to reveal a problem. If reanalysis solves the problem, then only submit the sample data from the analysis with surrogate spike recoveries within acceptable limits.
- **9.1.8.3** Re-extract and reanalyze the sample if none of the above actions solve the problem.
- **9.1.8.4** Upon analysis of the re-extracted sample, if surrogate values are still out of control, flag and report the initial sample data and initiate a NCM detailing that surrogate recoveries are out of control due to matrix effect. In the event that the surrogate values are in control, report only the re-extracted sample data.
- **9.1.9** Internal standards If the above criteria are not met, the samples must be reanalyzed in order to determine if the anomalies are the result of matrix interference, or are instrument related.
- **9.2** Instrument QC The following quality control samples are prepared with each batch of samples.

Step	Control Limit	Frequency
CCV	20%	Beginning of every 12 hour analysis period
IBL	< MRL	Daily after CCV or when contamination in the

## 9.2.1.1 System Checks

50ng of DFTPP is injected prior to calibration or analysis. The tailing factors of pentachlorophenol and benzidine must be less than 2 to proceed, otherwise maintenance must be performed. *Tailing must be checked prior to ICAL and at the beginning of each 12-hour period*. A printout confirming passing criteria should be included in calibrations and daily sequence packets. *Degradation*  $\leq$  20% for DDT. Correct problem then repeat breakdown check. No samples can be run until degradation is acceptable.

Because only Selective Ion Monitoring (SIM) is used, there are no comparisons between spectra, and the instrument tune evaluation is not performed. Instead the instrument is optimized for the relative intensities of the pre-selected analyte's ions of interest. Before analysis of samples, the calibration verification standard will be used to update these ion ratios. Positive identification of analytes is based on retention time and the presence of the ions of interest in a ratio that matches the calibration verification standard within  $\pm 20\%$ .

**9.2.1** The CCV is valid if the % difference or % drift is less than or equal to 20%. Up to 3 sporadic failures are permitted if the %D of the failing compounds is less than or equal

to 40%. Analytes may be reported if the CCV fails above the acceptance limits and the sample is non-detect for the failing analyte(s).

- **9.2.1.1** Analytes exceeding 20% difference must be flagged. However, percent difference above this limit does not disqualify reporting of the associated analytes.
- **9.2.1.2** The internal standard responses and retention times in the daily calibration check must be evaluated immediately after data acquisition. Retention times for the internal standards must be within 30 seconds from the mid-level standard in the most recent initial calibration sequence. Also, the areas of the internal standards must fall within 50-200% of the mid-level standard in the most recent initial calibration sequence. If these criteria, as well as the CCC, are not met, the mass spectrometer must be inspected for malfunctions and corrections must be made as appropriate.
- **9.2.1.3** Resolution of co-eluting compounds/isomeric pairs must be greater than 50% in the midpoint ICAL, CCV, and ICV. Resolution is calculated as 1 (the height of the valley between the two peaks divided by the average height of the two peaks). A printout confirming passing criteria should be included with all calibration and daily sequence packets.
- **9.2.2** If the instrument blank is greater than the reporting limit, investigate the source of contamination, preferably before continuing the sequence. Re-prepare and reanalyze all associated samples.
- **9.2.2.1** An instrument blank should be analyzed after any sample that has saturated ions from a given compound to check that the blank is free of interference and the system is not contaminated.

## 10.0 <u>Procedure</u>

#### **10.1** Sample Preparation

**10.1.1** For extraction procedures see "Preparation of Liquids for Semivolatile Analysis by EPA 3510C (Separatory Funnel Extraction)" SP-EXT-006 and "Preparation of Soils and Solids for Semivolatile Analysis by EPA 3550B (Sonication)" SP-EXT-001.

## 10.2 Calibration

Before any instrument is used as a measurement device, the instrument response to known reference materials must be determined. The manner in which various instruments are calibrated depends on the particular type of instrument and its intended use. All sample measurements must be made within the calibration range of the instrument. Preparation of all reference materials used for calibration must be documented.

Calibration Controls	Sequence	Control Limit
Calibration Standards	5-point (minimum) linearity	$\leq$ 20 % RSD or
	6-point for quadratic regression	$\geq 0.99$ for linear regression of $\geq 0.99$ for quadratic regression
Second Source (ICV)	After initial calibration	70-130% <sup>1</sup>

<sup>1</sup> Up to a total of three sporadic marginal failures may occur providing that no recovery is outside  $\pm$  40% of the expected value.

- **10.2.1** Initial calibration standards containing both semi-volatile target compounds and system monitoring compounds are analyzed at a minimum of five (5) concentrations in order to document the linearity of the instrument. The lowest calibration level must be at or below the established MRL and the highest calibration must encompass the expected analytical range. The remaining calibration standards must be evenly spaced between the lowest and highest standards. Initial calibration must be performed prior to sample analysis or upon failure to achieve continuing calibration acceptance criteria.
- **10.2.2** Only the highest or lowest calibration points may be rejected because of non-linearity. Rejection of such a point may affect the reporting limit or the linear range. Points within the curve <u>may not</u> be rejected. If a linear regression is used, a re-quantitation of the low point using the calibration curve must be within 70-130% of the true value.
- **10.2.3** If the ICV does not meet the acceptance criteria, re-prepare and re-analyze a new ICV standard from the stock. If the re-prepared standard does not meet the acceptance critera, consult your supervisor.

#### **10.3** Sample Analysis

- **10.3.1** After successful completion of a system performance check and passing CCV, load the samples onto the sampling device.
- **10.3.2** If required, perform dilutions prior to loading.
- **10.3.3** Add 1 µL of the internal spike solution for each 0.5mL of extract.
- **10.3.4** Initiate the analytical run.

#### 10.3.5 Compound Identification

- **10.3.5.1** Qualitative identification of compounds determined by this method is based on retention time and on comparison of the sample mass spectrum in SIM mode. The reference mass spectrum must be generated using the conditions of this method on the same instrument used for sample analysis. The characteristic ions from the reference mass spectrum are defined as the two ions of greatest relative intensity.
- **10.3.5.2** Relative retention times (RRT) must be within <u>+</u>0.06 RRT units of the RRT established by the continuing calibration.
- **10.3.5.3** The relative intensity of the Q-ion of the target analyte should agree within 30% of the relative intensity of the Q-ion in the reference spectrum.

## 10.3.6 Quantitation

**10.3.6.1** Analytes that have a calculated concentration exceeding the highest calibration standard must be diluted and re-analyzed.

- **10.3.6.2** Analytes that have a calculated concentration below the lower calibration limit but above the method detection limit must be reported and flagged with the "J" qualifier. (Note: Values below the MRL are qualitative only and are not legally defensible.)
- **10.3.6.3** Analytes that have a calculated concentration below the method detection limit must not be reported.

## 10.4 Data Review

- **10.5** Upon completion of the initial calibration run, the primary analyst acknowledge any TALS Data Review Checker (DRC) findings, add appropriate NCMs, and document the review on the data review checklist in TALS.
- **10.6** Upon completion of the analytical run, the primary analyst must review all data for compliance with criteria documented above, acknowledge any Data Review Checker (DRC) findings in TALS, and document the review on the data review checklist in DRC.
- **10.7** Upon completion of the primary review, the Department Supervisor (or designate) must perform a secondary peer review (see SP-QAG-023). The secondary reviewer completes the remaining items on the DRC checklist.

## 11.0 <u>Calculations / Data Reduction</u>

## 11.1 Response Factor

RF = (Ax \* Cis) / (Ais \* Cx)

where:

Ax = area of the characteristic ion for the compound of interest Ais = area of characteristic ion for the specific internal standard Cis = Concentration of the specific internal standard Cx = Concentration of the compound of interest

## 11.2 Percent Relative Standard Deviation (RSD)

%RSD = (SD / X) \* 100

where:

SD = Standard deviation of average RFs for a given compound X = Mean value of 5 RFs for respective compound

## 11.3 Daily Calibration RF % Difference

% Difference = (|RFi - RFc| / RFi) \* 100

where:

RFi = Response factor established during initial calibration RFc = Response factor established during continuing calibration

## 11.4 Analyte Concentration

Conc (ug/L) = (Ax \* Qis) \* D / (Ais \* RFi \* V)

where:

Ax = Area of characteristic ion of compound being measured Qis = Quantity of appropriate internal standard Ais = Area of characteristic ion of appropriate internal standard RFi = Response factor of compound being measured (mean value based on the initial calibration). V = Sample amount D = Dilution Factor

## 11.5 Spike Recovery

% Recovery = (Conc. Found / Conc. Expected) \* 100

## 11.6 Relative Percent Difference

RPD = (| X1-X2 | / ((X1+X2)/2)) \* 100

where: RPD = Relative Percent Difference X1 = Primary value X2 = Duplicate value

## 12.0 Maintenance Guide for GC/MS systems

See Attachment 1: Semivolatile GC-MS Maintenance

## 13.0 <u>Method Performance</u>

## 13.1 Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure in SOP SP-QAG-028. MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency or whenever there is a significant change in instrumentation or analytical methodology.

## 13.2 Demonstration of Capabilities

An initial demonstration of capability shall be performed before a new instrument or analytical method is brought into production.

Initial demonstrations of capability and annual demonstrations of capability are required for each analyst.

## **13.3** Training Requirements

See SP-QAG-026 for general training requirements.

#### 14.0 <u>Pollution Control</u>

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability).

#### 15.0 Waste Management

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to SP-SPL-006.

### 16.0 <u>References / Cross-References</u>

- **16.1** Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), Method 8270D, EPA SW846.
- **16.2** Determinative Chromatographic Separations, Method 8000C, EPA SW846, Rev. 3, 2003.
- **16.3** SP-EXT-001 Preparation of Solids and Soils for Semivolatile Analysis by EPA 3550C (Sonication).
- **16.4** SP-EXT-006 Preparation of Liquids for Semivolatile Analysis by EPA 3510C (Separatory Funnel Extraction).
- **16.5** SP-QAG-028, Method Detection Limit Studies, Limits of Detection, Reporting Limits and Limits of Quantitation.
- **16.6** SP-QAG-026, Basic Employee Training.
- **16.7** SP-SPL-006, Sample Disposal.
- **16.8** SP-QAG-023, Data Review and Reporting of Analytical Results.
- 16.9 CA-Q-S-002, Manual Integrations

## 17.0 <u>Method Modifications</u>

- 17.1 None
- 18.0 <u>Attachments</u>
- **18.1** Attachment 1: Semivolatile GC-MS Maintenance

## 19.0 <u>Revision History</u>

Revision 2, dated December 30, 2005

Revision 3, dated January 15, 2008

• Updated to new format

Revision 4, dated March 11, 2010

• Annual review

Revision 5, dated March 21, 2012

- Biennial review, updated to Method 8270D
- Updated calibration preparation to reflect actual practice
- Removed references to tuning procedure, not applicable to SIM
- Removed 1,4-dichlorobenzene-d4 as an internal standard
- Removed references to pentachlorophenol used in spiking standards. This will only be analyzed per client request.

Revision 6, dated April 24, 2014

• Biennial review, changed criteria for liner fit from r^2>0.995 to r^2>0.990

Revision 7, dated 9/29/2014.

• Biennial review.

Revision 08, dated 12/5/2014.

- Changed SOP title
- Added file address
- Added AK Small Volume requirement, section 8.0

Revision 09, dated 11/29/2016

- Biennial review
- Changed QA Manager to Terri Torres
- Updated initial temperature, section 6.1.2.2.
- Updated section 10.4 to current procedures.
- Updated SOP for MDLs, LODs, RLs and LOQs, section 15.5
- Added attachment 2, section 17.2.

Revision 10, dated 9/6/2017

- Added Maintenance Section, 12.0
- Updated Attachment 1 to include routine maintenance.
- Removed attachment 2, section 17.2
- Updated section 10.4 for data review checker (DRC)
- Removed method modification, section 17.0
- Updated reference from 8000B to 8000C, section 16.2

Revision 11, dated 7/16/2019

• Added tailing and DDT breakdown criteria to section 9.2.1.1

## Attachment 1. Semivolatile GC-MS Maintenance

## Daily Maintenance Checklist

- Replace injector septa daily for each inlet depending on sample load.
- Refill solvent rinse vials and empty solvent waste vials.
- All gas cylinders are checked and changed if the pressure is less than 500 psi.

## **Routine Instrument Maintenance**

The following activities constitute routine maintenance procedures and are performed either Mondays and Thursdays, or as necessary.

- Clip Column;
- Install new injection port liner;
- Install new septum;
- Install new gold seal and washer, or equivalent;

## Injector port maintenance is performed whenever the following conditions exist:

- High column bleed
- Peak broadening and/or tailing for polar analytes such as phenols
- Loss of sensitivity
- Calibration failures due to a loss of response
- Retention time drift
- Long or training solvent tail
- Overall loss of instrument response

Clean the inside of the injector body with a cotton swab dipped in hexane. Allow to air dry, and then replace the liner with a new or reconditioned liner that has been solvent rinsed, and muffled at 400 $^{\circ}$ C. re-pack the glasswool in the re-conditio ned liner, replace the septum and tighten the nut just past finger tight.

If column clipping is required, cool the inlet down to 45 °C. Using a ceramic column cutter, remove at least 4 cm of the column end, depending on the severity of the system contamination. Place a column nut and new ferrule over the end of the column and re-cut one inch from the column end to ensure that no ferrule fragments remain in the column. Feed the column into the tapered liner until seated, then hold pressure on the column while the nut is tightened to one turn past finger tight. At this point, the GC inlet is brought up to operating temperature. The system should then be leak checked.

## Detectors

- The Mass Spec. Ion source is removed and cleaned.
- Columns are removed, cut and re-inserted.

## Parts List

• Vespel/Graphite compact ferrules 0.8mm ID (Restek 20263), 0.5mm ID (Restek 20248), 0.4mm ID (Restek 20238).

- Injector Septa, 11mm diameter (Restek 20364)
- Glass Inlets: 2mm ID Goosneck Splitless (Restek 20796), 4mm Splitless sleeve w/FS Wool (Restek 22401), 2mm ID Splitless-Quartz (Restek 20915).
- Viton o-rings (Restek 20377)
- Gold Seals (Restek 21317)
- Column cutter (Crystal and Ceramic)

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- Flow measurement device
- GC tools and wrenches
- Snoop leak detection liquid
- Gas Purifier (Supelco OM-1)



Environment Testing TestAmerica

# EDB, DBCP and 1,2,3-Trichloropropane by Gas Chromatography with an Electron Capture Detector (GC/ECD) EPA 8011

Approvals (Signature/Date):			
Terri Torres Quality Assurance Manager	Date	Randee Arrington Laboratory Manager	Date

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Distributed To:

## 1.0 <u>Scope and Application</u>

## 1.1 Analytes, Matrix(s), and Reporting Limits

This SOP provides guidance in the extraction and determination of 1,2-dibromoethane (EDB), 1,2-dibromo-3-chloropropane (DBCP) and 1,2,3-Trichloropropane in an aqueous matrix utilizing a micro-extraction technique. This SOP also includes the analysis of EDB/DBCP in soil (not included in EPA 8011). Current reporting limits for these analytes can be found in *TALS*.

On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in the Quality Assurance Manual.

#### 2.0 <u>Summary of Method</u>

A known amount of aqueous (or soil) sample is transferred to a volumetric flask (or voa vial), salted, and extracted with hexane. The hexane extract is removed from the aqueous sample and analyzed by GC/ECD. Sample introduction is via an auto-sampler system in conjunction with a gas chromatograph. Identification of target analytes is accomplished by retention time comparison to a known standard. Quantitation is based upon target analyte response relative to a calibration curve. This method is restricted to use by, or under the supervision of, analysts experienced in the use of GC and organic analysis.

#### 3.0 <u>Definitions</u>

- **3.1** Batch: A group of 20 or less samples extracted and processed together within the same shift using the same reagents. Each batch must contain a minimum QC of a method blank, laboratory control sample, and lab sample duplicate. If sufficient sample is available, a matrix spike and matrix spike duplicate should be included in each analytical batch. If there is insufficient sample for a MS duplicate then a sample duplicate may be used.
- **3.2** RT: Retention time
- **3.3** %RSD: Percent relative standard deviation
- **3.4** Primary Stock Solution(s): Singular or standard combinations prepared with known concentration and purity. These standards are purchased from an ISO certified vendor and require documentation as to concentration, purity, and traceability.
- **3.5** Calibration Standards: Standards used to prepare and document the initial calibration curve. These standards are prepared by diluting primary stock solutions.
- **3.6** Calibration Check Standard (Initial Calibration Verification Standard- ICV): Standard analyzed immediately after the initial calibration curve to verify accuracy. This standard must be acquired from a source other than that of the primary stock solution. When a second source is not available and a different lot from the same source as the primary standards is used, the manufacturer must demonstrate that the lot was prepared independently from other lots.
- **3.7** Daily Calibration Check Standard (Continuing Calibration Verification- CCV): A standard run once every 10 samples and at the beginning and end of the run to verify validity of the initial calibration curve. This standard is made from the source supplying the primary stock solutions.
- **3.8** Laboratory Control Sample/Laboratory Control Sample Duplicate (Blank Spike/Blank Spike Duplicate): A blank matrix (reagent water) spiked with known analytes at a known concentration. The laboratory control sample and laboratory control sample duplicate (LCS/LCSD) are used to calculate method accuracy, precision and/or bias by comparing the calculated values to the known values.
- **3.9** Method Blank: A control sample consisting of a clean matrix (reagent water) with all reagents and standards that is carried through the entire analytical procedure. The method blank is used to assess the presence/absence of laboratory induced contamination.
- **3.10** Instrument Blank: A control sample consisting of reagent water that is only subjected to the analytical procedure. The instrument blank is used to assess the presence/absence of instrument induced contamination.
- **3.11** Matrix Spike/Matrix Spike Duplicate (MS/MSD): A field sample that is spiked with known analytes at known concentrations. The MS/MSD is used to assess analytical precision and possible matrix effects.
- **3.12** Sample Duplicate: A replicate of a given sample whose Relative percentage difference from the original sample is used to evaluate analytical precision.

### 4.0 <u>Interferences</u>

- **4.1** Impurities in the hexane extraction solvent account for the majority of interferences. Whenever interferences are noted in the method or instrument blank, the analyst should reanalyze the hexane to verify purity.
- **4.2** Sample contamination can occur from diffusion of volatile organics through the septum seal into the sample bottle during shipment and storage. Trip blanks may be used to monitor for this problem.
- **4.3** EDB at low concentrations may be masked by very high concentrations of DBCP.
- **4.4** Sufficient headspace must be allowed in the extraction flask to allow for analyte partitioning. Inadequate headspace will produce low recovery of analyte during the extraction process.
- **4.5** Emulsions may form in the final extract of samples containing petroleum contamination. Extracts exhibiting such emulsions should be centrifuged prior to analysis to aid in the separation of the hexane and contaminate.

### 5.0 Safety

Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document.

This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

### 5.1 Specific Safety Concerns or Requirements

None

### 5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **NOTE:** This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the SDS for each of the materials listed in the table. A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the SDS for each material before using it for the first time or when there are major changes to the SDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure	
Hexane	Flammable Irritant	500 ppm- TWA	Inhalation of vapors irritates the respiratory tract. Overexposure may cause lightheadedness, nausea, headache, and blurred vision. Vapors may cause irritation to the skin and eyes.	
Sodium Chloride	Irritant	NA	May cause mild irritation to the respiratory tract.	
Methanol	Flammable Poison Irritant	200 ppm- TW A	A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes.	
1 – Always add acid to water to prevent violent reactions.				
2 – Exposure	2 – Exposure limit refers to the OSHA regulatory exposure limit.			

### 6.0 Equipment and Supplies

### 6.1 <u>Instrumentation</u>

**6.1.1** Gas Chromatograph – HP 5890/6890 or equivalent, equipped with dual ECDs and autosampler.

Condition	Recommended setting
Injection Port Temp	250° C
Injection Volume	5 μL
Injector	Splitless with ECD
Flow	Constant 5psi
Liner	4 mm Quartz
Detector Temp	300° C
Initial Temp	50° C
Hold 1	5 minutes
Ramp	15º C per minute
Final Temp	280° C
Hold 2	1.67 minutes
Total Run Time	22 minutes (approx.)

Note: These conditions can vary by instrument. This is only a guideline.

**6.1.2** Columns: Restek RTX-CLPesticides I, 30 m, 0.32 mm ID, 0.50 μm df and Restek RTX-CLPesticides II, 30 m, 0.53 mm ID, 0.42 μm df or equivalent

Note: Other columns may be used. These were the columns in place at the time the SOP was prepared.

6.1.3 Data System - HP Chemstation

### 6.2 <u>Supplies</u>

- 6.2.1 Microsyringes 10, 25, 50, 100, 500, 1000 μL accurate to ± 5%
- 6.2.2 Fume hood
- 6.2.3 Autosampler vials and seals
- 6.2.4 Volumetric flasks 10 and 100 mL
- 6.2.5 Balance top loading w/ accuracy of + 0.01 g
- 6.2.6 16mm x125mm culture tubes
- **6.2.7** Sand (washed and ignited)
- 6.2.8 Solvent pump (2mL capable)

#### 7.0 <u>Reagents and Standards</u>

All standards should be stored below 0 °C until opened and after use.

- 7.1 Hexane, pesticide grade or higher
- 7.2 Methanol, pesticide grade or higher

- 7.3 Organic free water
- 7.4 Sodium chloride, laboratory grade
- **7.5** EDB/DBCP second source standard, diluted to fall at or below the midrange of the calibration curve.
- **7.6** Calibration Solutions (EDB/DBCP):
- **7.6.1** Stock Solution: purchased at a concentration of 2000 µg/mL (Restek).
- **7.6.2** Working Solution: 2.5 μL of the stock solution is diluted to a final volume of 5 mL with methanol for a final concentration of 1000 ng/mL (ppb).
- **7.7** Spike solutions for Laboratory Control Samples and Matrix Spikes: A final concentration of 1 μg/mL is made by diluting a stock 200 μg/mL EDB/DBCP (50 uL of stock into 10 mL hexane). Used for ICV (second source).

#### 8.0 <u>Sample Collection, Preservation, Shipment and Storage</u>

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time	Reference
Waters	Amber Glass, Teflon-lined lid	80 mL	Cool 4 <u>+</u> 2°C	7 Days for Sample; 40 Days for Extract <sup>1</sup>	N/A
Soils	4 or 8-oz. Glass	30 grams	Cool 4 <u>+</u> 2ºC	14 Days for Sample; 40 Days for Extract <sup>1</sup>	N/A

<sup>1</sup> If extract is not analyzed immediately, it should be stored upside down in a freezer.

#### 9.0 <u>Quality Control</u>

**9.1 Sample QC** - The following quality control samples are prepared with each batch of samples.

Quality Controls	Frequency	Control Limit
Method Blank (MB)	1 in 20 or fewer samples	< Rpt. Limit
Laboratory Control Sample (LCS)	1 in 20 or fewer samples	60-140%
LCS Duplicate (LCSD) (AK samples only)	1 in 20 or fewer samples	60-140%
LCS/LCSD RPD (AK samples only)	1 in 20 or fewer samples	20%
Matrix Spike (MS) <sup>1</sup>	1 in 20 or fewer samples	60-140%
MS Duplicate (MSD) <sup>1</sup>	1 in 20 or fewer samples	60-140%
MS/MSD RPD <sup>1</sup>	1 in 20 or fewer samples	20%
Sample Duplicate (DUP) <sup>2</sup>	1 in 20 or fewer samples	Statistical Limits <sup>3</sup>

<sup>1</sup> The sample selection for MS/MSD are randomly selected, unless specifically requested by a client.

<sup>2</sup> If requested by a client or if specified in the project work plan, a sample duplicate may be substituted for the MSD.

<sup>3</sup> Statistical control limits are updated annually and are updated into LIMS.

- **9.1.1** If the method blank is greater than the limit, investigate the source of contamination. Reprepare and reanalyze all associated samples. Exception: if the samples are non-detect the data may be reported with qualification.
- **9.1.2** If the LCS or LCSD recovery is outside the limit, check to be sure there are no errors in calculations and that the concentration of the analyte solution is correct. Check instrument performance to determine if it is within acceptable guidelines. Recalculate the data and/or reanalyze the extract if necessary. Re-prepare and reanalyze the samples if none of the above resolves the problem. Exception: if the BS/BSD fails high and the samples are non-detect the data may be reported with qualification.
- **9.1.3** If the LCS/LCSD RPD is greater than the limit, check to be sure that there are no errors in calculations, and that the same amount and source of analyte solution, solvent and water were used for both samples in the set. If the LCS/LCSD percent recoveries were within limits, the RPD failure may be qualified.
- **9.1.4** If the MS or MSD recovery is greater than the limit, check to be sure there are no errors in calculations and that the concentration of the analyte solution is correct. Check instrument performance to determine if it is within acceptable guidelines. Recalculate the data and/or reanalyze the extract if any of the above checks reveals a problem. If none of the above resolves the problem and the LCS is acceptable, narrate as a possible matrix effect.
- **9.1.5** If the MS/MSD RPD is greater than the limit, check to be sure that there are no errors in calculations, and that the same amount and source of analyte solution, solvent and water were used for both samples in the set. If the MS/MSD percent recoveries were within limits, the RPD failure may be qualified.
- **9.1.6** If the Sample Duplicate RPD is greater than the limit, check to be sure that there are no errors in calculations, and that the same amount and source of analyte solution, solvent and water were used for both samples in the set. If the LCS is acceptable, narrate as a possible matrix effect.
- **9.2** Instrument QC The following quality control samples are prepared with each batch of samples.

Step	Standards	Control Limit	Frequency
IBL	NA	< MRL	Beginning of each
			run
CCV	EDB and DBCP	60-140% <sup>1</sup>	Beginning of each run, every 10 samples, end of run

<sup>1</sup> The lab may establish control-charted limits if they are as equal to or less than the methodstated limits.

**9.2.1** If the instrument blank is greater than the limit, investigate the source of contamination, preferably before continuing the sequence. Re-prepare and reanalyze all associated samples.

- **9.2.2** If the CCV does not meet the acceptance criteria, re-prepare and re-analyze a new CCV standard from the stock. If the re-prepared standard does not meet the acceptance critera, the initial calibration must be repeated. No more than two consecutive injections of the calibration verification may be processed.
- **9.2.2.1** Any samples associated with failing closing CCVs where the response for the analyte in the calibration verification standard is above the acceptance limit and the analyte was not detected in any of the samples analyzed since the previous passing verification, do not need to be reanalyzed (as the verification standard has demonstrated that the analyte would have been detected were it present).

### 10.0 <u>Procedure</u>

### **10.1** Sample Preparation

### **10.1.1** Water Sample Extraction

- **10.1.1.1** Allow samples to come to room temperature before extraction.
- **10.1.1.2** Quantitatively measure and transfer 80 mL of sample to a 100 mL volumetric flask.
- **10.1.1.3** Add  $14.0 \pm 0.2$  grams of sodium chloride. Gently swirl to dissolve the salt.
- **10.1.1.4** If the sample is designated as a blank spike, blank spike duplicate, matrix spike, or matrix spike duplicate add 10 μL of the dilute working spike solution. Add 40uL CCV working standard (1000 ug/L) for cal high point.
- **10.1.1.5** Quantitatively add 2 mL of hexane.
- **10.1.1.6** Cap the neck of the flask and shake for 1-2 minutes.
- **10.1.1.7** Add sufficient de-ionized water to bring the liquid level into the flask neck.
- **10.1.1.8** Carefully remove the hexane layer (top) and transfer to a clean, labeled sample extract vial. Avoid transferring any of the aqueous layer.
- **10.1.1.9** If emulsions are noted in the final extracts, centrifuge the sample.
- **10.1.1.10** If analysis is not to be performed immediately, store the extracts upside down in the freezer.

#### **10.1.2** Soil Sample Extraction

- **10.1.2.1** Allow samples to come to room temperature before extraction.
- **10.1.2.2** Remove 10 grams of soil to dry weight tin. Record the actual sample weight on the bench sheet. Transfer to a 16x125mm culture tube. If sample is wet, tare out the tube and weight directly into the culture tube, record the weight. (NOTE: if you are unable to get the soil into the culture tube or there are rocks in the sample, weigh out

into a voa vial, add 10mL of water, shake for 1 minute, then transfer the water into the culture tube and complete steps 10.1.2.5-10.1.2.7.)

- **10.1.2.3** If the sample is designated as a blank spike, blank spike duplicate, matrix spike, or matrix spike duplicate add 10 μL of the dilute working spike solution. Add 40uL CCV working standard for calibration high point.
- **10.1.2.4** Immediately add 10 mL of water to all samples.
- **10.1.2.5** Shake for 1 minute. Then add 2 mL of hexane and shake for 1 minute.
- **10.1.2.6** Centrifuge the samples for 1 minute.
- **10.1.2.7** Remove hexane to clean microfuge vial.
- **10.1.2.8** If analysis is not to be performed immediately, store the extracts upside down in the freezer.

#### 10.2 Calibration

Before any instrument is used as a measurement device, the instrument response to known reference materials must be determined. The manner in which various instruments are calibrated depends on the particular type of instrument and its intended use. All sample measurements must be made within the calibration range of the instrument. Preparation of all reference materials used for calibration must be documented.

- **10.2.1** All Calibration standards must be processed through the analytical process (extracted like a sample). Extract the 20.0 ng/mL (level 7) and dilute remaining points from this extract.
- **10.2.2** Working calibration standards: At least five calibration levels are made with the following dilutions of the *extracted calibration point* into a total of 500 μL hexane. Additional levels may be added but must meet acceptance criteria for inclusion in the curve.

Level	Amount of <i>Extracted</i> CAL POINT (μL)	Final Concentration (ng/mL)
1	5	0.2
2	10	0.4
3	25	1.0
4	50	2.0
5	125	5.0
6	250	10.0
7	500	20.0

**10.2.3** Only the highest calibration points may be rejected because of non-linearity. Rejection of such a point may affect the reporting limit or the linear range. Points within the curve **may not** be rejected. An entire calibration level may be rejected for any valid analytical reason. The reason for rejection must be documented on the raw data and the data for the rejected level must be included with the initial calibration raw data.

**10.2.4** Utilize "linear regression" or "average response factors" to establish the calibration curve and measure acceptance criteria.

Calibration Controls	Sequence	Control Limit
Calibration Standards	5-point (minimum for % RSD or linear)	< 10% RSD
Initial Cal. Verif. (ICV)	After initial calibration	60-140% <sup>1</sup>

<sup>1</sup> The lab may establish control-charted limits if they are as equal to or less than the method-stated limits.

- **10.2.5** If the ratio of the response to concentration (calibration factor) is a constant over the working range (<10% relative standard deviation), linearity can be assumed and the average ratio or calibration factor can be used in place of place of a calibration curve.
- **10.2.6** The % RSD for both the primary and secondary columns must be <10% if the response factors are utilized. In the event that the 10% is exceeded, then linear regression. The curves cannot be forced through the origin, the correlation coefficient (r) must be > 0.99 and the absolute value of the intercept must be less than the MRL.
- **10.2.7** If the ICV does not meet the acceptance criteria, re-prepare and re-analyze a new ICV standard from the stock. If the re-prepared standard does not meet the acceptance critera, consult your supervisor.

### 10.3 Sample Analysis

- **10.3.1** If necessary, allow the extract to reach room temperature before analysis.
- **10.3.2** Transfer a small amount of the sample extract to a labeled autosampler vial with a vial insert.
- **10.3.3** Analyze the sample extracts and all QA samples utilizing the same parameters used for the initial calibration and calibration verification.

#### 10.3.4 Diluted Analysis

- **10.3.4.1** If the concentration of a target compound in a sample exceeds the concentration in the highest calibration standard, the sample must be diluted.
- **10.3.4.2** Transfer a known amount of the original extract to a clean vial and add the appropriate amount of hexane to achieve the desired dilution.
- **10.3.4.3** Analyze the sample extracts utilizing the same parameters used for the initial calibration and calibration verification.
- **10.3.5** Analytes that have a calculated concentration below the lower calibration limit but above the method detection limit must be reported and flagged with the "J" qualifier. (Note: Values below the MRL are qualitative only and are not legally defensible.)
- **10.3.6** Analytes that have a calculated concentration below the method detection limit must not be reported.

### 10.3.7 Identification

- **10.3.7.1** Identify EDB and DBCP in the sample chromatogram by comparing the retention time of the suspect peak to retention times generated by the calibration standards and the check standard.
- **10.3.7.2** Results that have %D > 40% between the columns must be flagged with a qualifier indicating which result (highest or lowest) was reported. Check the chromatograms to see if an obviously overlapping peak is causing an erroneously high result. If no overlapping peaks are noted, examine the baseline parameters established by the instrument data system (or operator) during peak integration. A rising baseline may cause the mis-integration of the peak for the lower result.
- **10.3.7.3** If no anomalies are noted, review the chromatographic conditions and report the most appropriate result.

#### 10.3.8 Quantitation

- **10.3.8.1** Quantitate the initial results against the established calibration curve.
- **10.3.8.2** Determine the concentration of the injected sample according to the equation documented in section 11.

#### 10.3.9 Manual Integrations

- **10.3.9.1** Manual integrations should be employed only in situations where the data system has incorrectly identified a signal or incorrectly quantitated a signal thereby producing an obvious bias.
- **10.3.9.2** Refer to CA-Q-S-002 for specifics on manual integration.

### **10.3.10** Moisture Determination for Soils

- **10.3.10.1** Since all results are reported on a dry-weight basis the percent solids must be determined.
- **10.3.10.2** Refer to SP-SPL-003 to determine the percent solids.

#### 10.3.11 Data Review

- **10.3.11.1** Upon completion of the initial calibration run, the primary analyst acknowledge any TALS Data Review Checker (DRC) findings, add appropriate NCMs, and document the review on the data review checklist in TALS.
- **10.3.11.2** Upon completion of the analytical run, the primary analyst must review all data for compliance, acknowledge any TALS Data Review Checker (DRC) findings, add appropriate NCMs, and document the review on the data review checklist in TALS.

**10.3.11.3** Upon completion of the primary review, the Department Supervisor (or designate) must perform a secondary peer review (see SP-QAG-023). The secondary reviewer reviews the data review checklist (DRC) in TALS.

### 11.0 <u>Calculations / Data Reduction</u>

### 11.1 Response Factor

RF = (Ax) / (Cx)

Ax = area of the characteristic ion for the compound of interest Cx = Concentration of the compound of interest

## 11.2 Percent Relative Standard Deviation (RSD)

%RSD = (SD / X) \* 100

SD = Standard deviation of average RFs for a given compound X = Mean value of 5 RFs for respective compound

### 11.3 Daily Calibration RF % Difference

% Difference = (|RFi - RFc| / RFi) \* 100

RFi = Response factor established during initial calibration RFc = Response factor established during continuing calibration

### 11.4 Analyte Concentration

Conc (ug/L) = (Ax)/(RFi)

Ax = Area of characteristic ion of compound being measured RFi = Response factor of compound being measured (mean value based on the initial calibration).

### **11.5** Sample Concentration

Conc. = (Cn)(Ve)(d) Vt Cn= Analyte Concentration Ve= Volume Extracted Vt= Total sample volume extracted D= Dilution factor (if required)

### 11.6 Spike Recovery

% Recovery = (Conc. Found / Conc. Expected) \* 100

## 11.7 Relative Percent Difference

RPD = (| X1-X2 | / ((X1+X2)/2)) \* 100

RPD = Relative Percent Difference X1 = Primary value X2 = Duplicate value

### 11.8 Moisture Determination %

Moisture%= [(A-C)/(A-B)] x 100

A= weight of aluminum boat + wet sample B=weight of boat C= weight of boat + dry sample

### 12.0 Maintenance Guide for GC/MS systems

See Attachment 1: Semivolatile GC Maintenance

### 13.0 <u>Method Performance</u>

### 13.1 Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure in Section 20.7 of the QA Manual. MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency or whenever there is a significant change in instrumentation or analytical methodology (see SP-QAG-010).

### 13.2 Demonstration of Capabilities

An initial demonstration of capability shall be performed before a new instrument or analytical method is brought into production.

Initial demonstrations of capability and annual demonstrations of capability or passing annual PE results are required for each analyst.

### 13.3 Training Requirements

See SP-QAG-026 for general training requirements.

### 14.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability).

### 15.0 <u>Waste Management</u>

All waste will be disposed of in accordance with Federal, State and Local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this method and the policies in section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention."

The following waste streams are produced when this method is carried out:

- Solvent waste generated by the extraction: Collected in mixed solvent waste stream and sent out for disposal.
- Acidic and/or alkaline waste generated in the laboratory: Collected in solvent/acid waste stream container and sent out for disposal.
- All contaminated disposable glassware utilized in the laboratory: Glassware is cleaned with acetone and methylene chloride which is collected in a mixed solvent waste stream and sent out for disposal.

### 16.0 <u>References / Cross-References</u>

- **16.1** TestAmerica Quality Assurance Manual
- **16.2** TestAmerica Health & Safety Manual
- **16.3** US EPA Method 8011, "1,2-Dibromoethane and 1,2-dibromo-3-chloropropane by Microextraction and Gas Chromatography", SW-846, Rev 0, July 1992.
- **16.4** US EPA Method 8000C, "Determinative Chromatographic Separations", SW-846, Rev. 3, March 2003.
- **16.5** CA-Q-S-002, Acceptable Manual Integration Practices
- **16.6** SP-QAG-026, Basic Employee Training
- **16.7** SP-SPL-006, Sample Disposal
- 16.8 SP-QAG-023, Data Review and Reporting of Analytical Results
- **16.9** SP-SPL-003, Percent Solids

### 17.0 <u>Method Modifications</u>

ltem	Method 8011	Modification
1	8.1.4	The method states that the laboratory must demonstrate the ability to analyze a QC reference sample on a weekly basis. QC are run after initial calibration and on days samples are being run.
2	7.3.3 & 7.4.1	Use 80 mL for extraction rather than the 35 mL in the method. The amount of NaCl is adjusted accordingly.
3	NA	Soil extraction is not discussed in the EPA method.
4	7.5	3-5 μL injected instead of 2 μL
5	5.10	CCV conc is 5 µg/L not 25 µg/L

### 18.0 <u>Attachments</u>

**18.1** Attachment 1: Semivolatile GC Maintenance

#### 19.0 <u>Revision History</u>

Revision 1, dated 12/30/05 Revision 2, dated 2/15/08

Reasons for Change, Revision 3:

- General Update:
- Updated safety and waste disposal sections according to corporate template
- Updated reference to new corporate manual integration SOP
- SW-846 Update:
- In section 10.2.4, changed linear r2 from > 0.995 to > 0.99
- Added section 10.2.5 to specify that the curve may be forced through zero
- Modified section 10.3.7 to indicate that in some situations it may be appropriate to report the low result
- Changed reference from 8000B to 8000C

Reasons for Change, Revision 4, dated 7/30/10:

- Annual Review
- Removed all references to the use of surrogates.
- Removed all references to the use of quadratic regression.

Reasons for Change, Revision 5, dated 8/21/12:

- Biannual Review
- Changed working standard preparation instructions in Section 7.
- Added instructions for preparing calibration points in Section 10.

Revision 6, dated 9/17/2014:

- Biennial review.
- Added file location

Revision 7, dated 10/27/2016:

- Biennial review.
- Added all analytes to be run under method to Title and Summary.
- Changed injection volume to 5uL from 3, section 6.1.1
- Changed low point from 0.5 to 0.4, section 10.2.2
- Added GC Semivolatile EDB Initial Calibration Review Checklist, Attachment 1
- Updated QCAR to Data review checklist, Attachment 2

Revision 8, dated 04/12/2017:

- Changed soil prep method to include the 10mL water step.
- Changed the final volume for soils from 10mL to 2mL.
- Changed the soil vessel from Voa vial to 16mm x 125mm culture tube.
- Added the 0.2 calibration point to the instrument calibration curve table.
- Changed the spike amount from 50uL to 10uL for the LCS, MS, MSD and ICV. Changed the high calibration point spike amount from 200uL to 40uL.

- Removed GC Semivolatile EDB Initial Calibration Review Checklist, Attachment 1 and added instructions for completing the Data Review Checklist (DRC) in TALS Revision 9, dated 09/6/2017:
- Added Maintenance Section, 12.0
- Added Attachment 1; Semivolatile GC Maintenance.

Revision 10, dated 11/13/18:

• Added storage requirements for standards, section 7.0

Revision 11, dated 11/23/20:

- Removed Element references
- Updated the Calibration table with amounts for each point

## Attachment 1. Semivolatile GC Maintenance

### Daily Maintenance Checklist

- Replace injector septa daily for each inlet depending on sample load.
- Refill solvent rinse vials and empty solvent waste vials.
- All gas cylinders are checked and changed if the pressure is less than 500 psi.

### **Routine Instrument Maintenance**

The following activities constitute routine maintenance procedures and are performed either Mondays and Thursdays, or as necessary.

- Clip Column;
- Install new injection port liner;
- Install new septum;
- Install new gold seal and washer, or equivalent;

### Injector port maintenance is performed whenever the following conditions exist:

- High column bleed
- Peak broadening and/or tailing for polar analytes such as phenols
- Loss of sensitivity
- Calibration failures due to a loss of response
- Retention time drift
- Long or training solvent tail
- Overall loss of instrument response

Clean the inside of the injector body with a cotton swab dipped in hexane. Allow to air dry, and then replace the liner with a new or reconditioned liner that has been solvent rinsed, and muffled at 400°C. re-pack the glasswool in the re-conditioned liner, replace the septum and tighten the nut just past finger tight.

If column clipping is required, cool the inlet down to 45°C. Using a ceramic column cutter, remove at least 4 cm of the column end, depending on the severity of the system contamination. Place a column nut and new ferrule over the end of the column and re-cut one inch from the column end to ensure that no ferrule fragments remain in the column. Feed the column into the tapered liner until seated, then hold pressure on the column while the nut is tightened to one turn past finger tight. At this point, the GC inlet is brought up to operating temperature. The system should then be leak checked.

## Detectors

- Columns are removed, cut and re-inserted.
- ECD's are wipe tested yearly.

### Parts List

• Vespel/Graphite compact ferrules 0.8mm ID (Restek 20263), 0.5mm ID (Restek 20248), 0.4mm ID (Restek 20238).

- Injector Septa, 11mm diameter (Restek 20364)
- Glass Inlets: 2mm ID Goosneck Splitless (Restek 20796), 4mm Splitless sleeve w/FS Wool (Restek 22401), 2mm ID Splitless-Quartz (Restek 20915).
- Viton o-rings (Restek 20377)
- Gold Seals (Restek 21317)

- Wipe Test Kit
- Column cutter (Crystal and Ceramic)
- Flow measurement device
- GC tools and wrenches
- Snoop leak detection liquid
- Gas Purifier (Supelco OM-1)



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# Title: Analysis of Volatile Organic Compounds by Method 8260C or 8260D Utilizing Purge and Trap Gas Chromatography/Mass Spectrometry

Approvals			
Terri Torres	Date	Chris Williams	Date
Quality Assurance Manager		Laboratory Director	

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### 1.0 Scope and Application

1.1 This SOP provides guidance in determining volatile organic compounds in a variety of waste matrices and is applicable to a wide range of organic compounds. This SOP is (1) applicable to analyses required by the Office of Solid Waste (OSW), and (2) based upon the guidelines established in SW 846, Revision III. For the reporting of any compound by the utilization of this SOP, all minimum acceptance criteria must be achieved.

Compound	CAS #
Acetone	67-64-1
Benzene	71-43-2
Bromobenzene	108-86-1
Bromochloromethane	74-97-5
Bromodichloromethane	75-27-4
Bromoform	75-25-2
Bromomethane	74-83-9
2-Butanone	78-93-3
n-Butylbenzene	104-51-8
sec-Butylbenzene	135-98-8
tert-Butylbenzene	98-06-6
Carbon disulfide	75-15-0
Carbon tetrachloride	56-23-5
Chlorobenzene	108-90-7
Chloroethane	75-00-3
Chloroform	67-66-3
Chloromethane	74-87-3
2-Chlorotoluene	95-49-8
4-Chlorotoluene	106-43-4
Dibromochloromethane	124-48-1
1,2-Dibromo-3-chloropropane	96-12-8
1,2-Dibromoethane	106-93-4
Dibromometnane	74-95-3
1,2-Dichlorobenzene	95-50-1
1,3-Dichlorobenzene	541-73-1 106.46.7
Dichlorodifluoromothana	75 71 9
	75-34-3
1,1-Dichloroothano	107-06-2
1,2-Dichloroethene	75-35-4
cis-1 2-Dichloroethene	156-50-2
trans-1 2-Dichloroethene	156-60-5
2-Chloroethyl Vinyl Ether	110-75-8
2-Mothylpontano	107-83-5
	107-05-01
3-Chioropropene	107-05-01
	96-14-0
Acetonitrile	75-05-8
Acrolein	107-02-8
Acrylonitrile	107-13-1
Cyclohexane	110-82-7
Diisopropyl Ether	108-20-3
Ethanol	64-17-5
Ethyl Acetate	141-78-6
Ethyl Methacrylate	97-63-2
Ethyl tert-Butyl Ether	637-92-3

CAS #
78-87-5
142-28-9
594-20-7
563-58-6
10061-01-5
10061-02-6
100-41-4
87-68-3
591-78-6
08-82-8
99-87-6
75-09-2
108-10-1
01-20-3
102-658-1
100-000-1
620.20.6
70.24.5
19-34-3
127-10-4
07.61.6
71 55 6
71-55-6
79-00-5
79-01-0
75-09-4
90-10-4
109.67.9
75 01 4
100-30-3, 100-42-3
90-47-0
76-13-1
306-83-2
74-88-4
78-83-1
1634-04-4
126-98-7
96-37-7
71-36-3
110-54-3
994-05-8
75-65-0
110-57-6
108-05-4

### 2.0 <u>Summary of Method</u>

This method is used to determine volatile organic compounds in a variety of matrices. It is applicable to water, soil, sediment, sludge and waste drum samples.

This method can be used to quantify most volatile organic compounds that have a boiling point less than 200°F. It is also limited to those compounds that elute as sharp peaks from a capillary column. A listing of applicable compounds and their characteristic ions appears in Table 1 of method 8260C and 8260D.

A portion of sample, measured into a sample vessel, is purged with an inert gas. The volatile compounds are transferred to a trap containing retarding materials. The trap is then backflushed with the inert gas and rapidly heated to effectively transfer the compounds to the GC column. The GC oven is then temperature ramped to separate the compounds and introduce them to the source. The mass filter separates the ions, which are then detected by the analyzer. The data system then provides qualitative and quantitative information concerning the sample.

Identification of target analytes is accomplished by relative retention time (RRT) and mass spectra comparison to known standards. Quantitation is based upon target analyte response relative to an internal standard utilizing a five point (or greater) calibration curve

### 3.0 <u>Definitions</u>

- 3.1 <u>Blank Matrix</u>: Reagent water, purged with inert gas for at least 4 hours, or Ottowa sand (or equivalent).
- 3.2 <u>Batch</u>: A group of 20 or less samples extracted and processed together within the same shift using the same reagents. Each batch must contain a minimum QC of a method blank, laboratory control sample, matrix spike and a duplicate. If sufficient sample is available, a matrix spike duplicate should be included in each analytical batch.
- 3.3 <u>Primary Stock Solution(s)</u>: Singular or standard combinations prepared with known concentration and purity. These standards are purchased from an ISO certified vendor and require documentation as to concentration, purity, and traceability.
- 3.4 <u>Calibration Standards</u>: Standards used to prepare and document the initial calibration curve. These standards are prepared by diluting primary stock solutions as specified in Section 7.0.
- 3.5 <u>Calibration Check Standard</u>: Standard analyzed immediately after the initial calibration curve to verify accuracy. This standard must be acquired from a source other than that of the primary stock solution. When a second source is not available and a different lot from the same source as the primary standards is used, the manufacturer must demonstrate that the lot was prepared independently from other lots. Documentation as to concentration, purity, and traceability is required.
- 3.6 <u>Daily Calibration Check Standard</u>: A standard run once every 12 hours (at a minimum) to verify validity of the initial calibration curve. This standard is made from the source supplying the primary stock solutions

- 3.7 <u>Surrogate Standards</u>: Compounds used to evaluate extraction efficiency. Compounds used as surrogates are Dibromofluoromethane, toluene-d8, 4bromofluorobenzene, and 1,2-dichloroethane-d4.
- 3.8 <u>Internal Standards</u>: Compounds used in the quantitation of target analytes. Compounds used as internal standards are fluorobenzene, 1,4-difluorobenzene, tert-Butyl-d9-alcohol, chlorobenzene-d5, 1,4-Dioxane-d-8, and dichlorobenzene-d4.
- 3.9 <u>Laboratory Control Sample/Laboratory Control Sample Duplicate (Blank Spike/Blank Spike Duplicate)</u>: A blank matrix spiked with known analytes at a known concentration. The laboratory control sample and laboratory control sample duplicate (LCS/LCSD) are used to calculate method accuracy, precision and/or bias by comparing the calculated values to the known values.
- 3.10 <u>Method Blank (MB)</u>: A control sample consisting of a blank matrix with all reagents and standards that is carried through the entire analytical procedure. The method blank is used to assess the presence/absence of laboratory induced contamination.
- 3.11 <u>Instrument Blank</u>: A control sample consisting of reagent water that is only subjected to the analytical procedure. The instrument blank is used to assess the presence/absence of instrument induced contamination.
- 3.12 <u>Matrix Spike/Matrix Spike Duplicate (MS/MSD)</u>: A field sample that is spiked with known analytes at known concentrations. The MS/MSD is used to assess analytical precision and possible matrix effects.

### 4.0 Interferences

- 4.1 Volatile material and/or impurities in laboratory supplies can be a significant source of contamination. The use of high purity reagents, gasses, and supplies is essential to the successful analysis of VOCs by this method.
- 4.2 Carryover may occur when samples containing high concentrations of VOCs are analyzed within a batch. If sample concentration has historically been high or is suspected to contain high analyte concentrations, screening or dilution is recommended prior to analysis.
- 4.3 Precautions should be taken to minimize the exposure of VOC work areas to volatile laboratory solvents, such as acetone and methylene chloride. If elevated levels (above one-half the MRLs) of these solvents are found in the method blank, the samples will require re-analysis or appropriate flagging. Subtraction of blank values from sample results is not permitted.
- 4.4 The laboratory analyst must perform the method in accordance with this SOP or as directed by the Department Supervisor. The laboratory analyst will resolve non-conformances in methods and data, either individually, or with the assistance of the Department Supervisor or the Operations Manager. The laboratory analyst will report out-of-control data or events to the Department Supervisor and/or QA Manager.

- 4.5 The Department Supervisor, Operations Manager, and/or QA Manager will assist the laboratory analyst in resolving non-conformances.
- 4.6 The Department Supervisor will review and approve data, methodology, and final reports for all analyses performed in his/her department.
- 4.7 The QA Manager shall verify adherence to this SOP through annual audits, nonconformance reports, and performance evaluation studies.

### 5.0 <u>Safety</u>

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001), Radiation Safety Manual and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closedtoe, nonabsorbent shoes are a minimum.

#### 5.1 Specific Safety Concerns or Requirements

- 5.1.1 The gas chromatograph and mass spectrometer contain zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.
- 5.1.2 The mass spectrometer is under deep vacuum. The mass spectrometer must be brought to atmospheric pressure prior to working on the source.
- 5.1.3 There are areas of high voltage in both the gas chromatograph and the mass spectrometer. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

### 5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the SDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the SDS for each material before using it for the first time or when there are major changes to the SDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Methanol	Flammable Poison Irritant	200 ppm- TWA	A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

### 6.0 Equipment and Supplies

### 6.1 Gas Chromatograph / Mass Spectrometer Instrumentation

- 6.1.1 <u>Gas Chromatograph</u> HP 5890/6890 or equivalent
  - 6.1.1.1 Analytical systems complete with a temperature programmable chromatograph and the appropriate interface for sample introduction. The system includes all required accessories including columns and gases.
- 6.1.2 Mass Spectrometer HP 5970/5971/5972/5973 or equivalent
  - 6.1.2.1 The analytical system must be capable of scanning from 35 to 300 amu every 2 seconds or less at 70 volts electron energy in the electron impact ionization mode. The system must be capable of producing the spectrum listed in Section 9.1 for 4-bromofluorbenzene (BFB). To ensure sufficient mass spectral definition, the desirable mass spectrometer scan rate should allow at least five mass spectral data points during elution from the GC.
- 6.1.3 <u>Purge & Trap System</u> OI Eclipse 4660/4551-A (or equivalent)
  - 6.1.3.1 The purge and trap system includes purging chamber/autosampler, trap and desorber.
- 6.1.4 Columns: Restek Rtx VMS 60m, 0.25mm ID, 1.4um df or equivalent

**Note:** Other columns may be used. These were the columns in place at the time the SOP was prepared.

- 6.1.5 Data System HP Chemstation and Chrom
  - 6.1.5.1 A computer system that allows continual acquisition and storage of all mass spectra obtained during the analytical process. The computer must have software that allows searching of any MS data file for specific ion masses and allows plotting of ion abundance versus time or scan numbers.

## 6.1.6 Miscellaneous

- OI Trap # 10 or equivalent
- Gas tight syringes (1, 10, 25, 50, 100, 250, and 1000 microliter), accurate to + 3%
- Luer lock syringes (5 milliliter), accurate to + 1%
- 2-2 Liter separatory funnels
- pH paper
- 40 mL VOA vials w/screw cap and Teflon septum
- mL glass vial w/Teflon lined screw cap
- Fume hood
- Balance top loading w/ accuracy of + 0.01 g.
- 6.2 <u>Maintenance</u>: Out of service or malfunctioning equipment must be clearly marked and stored in such a manner as to maximize laboratory workspace and minimize the possibility of inappropriate use of a malfunctioning piece of equipment.

## 6.3 <u>Preventive Maintenance</u>

Instrumental maintenance can be categorized as daily and "as required".

## 6.3.1 Daily Maintenance

6.3.1.1 The most routinely performed maintenance includes:

- Purge-line or sample transfer line rinses within the concentrator and
- vial autosampler
- Analysis of blanks after high level samples
- GC oven bake after high level samples

## 6.3.2 "As Required"

Most maintenance is done on an "as needed" basis, is operator determined and can be categorized as GC, Concentrator, or MS related.

6.3.2.1 GC Related

- change column; condition new column
- check helium flow rate
- change gas cylinders and moisture trap

## 6.3.2.2 MS Related

- clean source/rods and anything associated with that activity
- replace electron multiplier
- change filaments

### 6.3.2.3 Concentrator Related

- change transfer line; clean transfer line
- replace trap; condition new trap
- run 20 ug/L Bromoform standard to check for formation of Chloromethane and Bromomethane.

- refurbish Concentrator
- check purge pressure and flow rate
- analysis of position blanks after high-level samples
- change bulk head fitting

6.3.2.4 Autosampler Related

- change sparge needle
- change pencil filters
- flush standard pickups
- calibrate standard valve
- run vial position calibration
- clean transfer rods
- oil bearings

Required maintenance may be performed for a variety of reasons. Certain trouble-flags will indicate what maintenance procedures may be required. A description of the situation, actions taken and follow-up must be documented in the instrument maintenance logbooks.

### 7.0 <u>Reagents and Standards</u>

Note: All standards are prepared in Class A volumetric flasks.

The majority of the calibration standards are EPA certified, A2LA or second-source verified by the standard vendor in situations where suitable SRMs (Standard Reference Material) was available. For those compounds where standards must be made from neat material (due to instability) or some non-routine compounds, **where available**, a second-source is purchased and used in the LCS to verify the standard

Each time new standards are prepared and a new initial calibration is required, the standards are verified against a second-source LCS (ICV-Initial Calibration Verification standard) prior to any sample analysis. This holds for all routine compounds and those available as second-source material in the LCS.

All neat standards/kits received are entered into TALS (LIMS). A standards label is printed & affixed to the bottle/kit. All neat standards are then stored in a separate freezer at approximately –15°C until needed. Lot # of Methanol reagent used is also tracked in TALS.

### 7.1 Solvents

- 1:1 HCl (Trace metal grade)
- Purge & Trap Grade Methanol (MeOH)
- Organic free water
- Volatile Grade MeOH

### 7.2 <u>Miscellaneous</u>

- stainless steel spatula
- assorted amber and clear Teflon-lined screw-capped vials (1.5-2.0 mL, 3.5-5.0 mL)
- cleaned 40 mL vials w/Teflon-lined screw-caps
- assorted volumetrics (10 mL, 20 mL, 25 mL, 50 mL and 100 mL)

### 7.3 Spike Solutions and Intermediate Calibration Standards

The life of an unopened flame sealed standard is set by the vendor for all purchased standards. All unopened standards are stored according to vendor recommendations. Opened/prepared standards have a life of 6 months and are stored in the freezer at -15°C. 8260 Standards containing gases are stored in GC vials with inserts and have a life of 6 months from preparation or 1 week from first use. Fresh standard (or a new vial) should be prepared/used if percent drift exceeds 20% for the gases. Dichlorodifluoromethane and chloromethane will usually be the first compounds to evaporate and should be monitored very closely.

8260C Internal Standard/Surrogate Solu	ution Soil and Water (SAM 1ul/5ml purge)
--	--

<u>10mL FV (in MeOH)</u> (FV = Final Volume)	<u>Final ppm:</u>	250-IS/150- Surrogate		
Standard	<u>Volume</u> (mL)	Part #	<u>Conc.</u>	<u>Manufacturer</u>
			200-13/100-	

8260C	<b>AK Soil</b>	Field	Surrogate
02000	/		ounoguto

Final ppm:

2.4

100mL FV (in MeOH)

	<u>Volume</u>			
<u>Standard</u>	<u>(mL)</u>	<u>Part #</u>	Conc.	<u>Manufacturer</u>
a,a,a - Trifluorotoluene	.024	30083	10000ug/mL	Restek

### 8260 Water & Soil Spike (Full List)

### 8260 Full List

10mL FV (in MeOH) Final ppm: 100/500

	<u>Volume</u>			
<u>Standard</u>	<u>(mL)</u>	Part #	<u>Conc.</u>	Manufacturer
8260 List 1/Std #1 Megamix	0.5	571992	2000ug/mL	Restek
8260 List 1/Std #2 Ketones	0.5	569721	10000ug/mL	Restek
8260 List 1/Std #3 Gases	0.5	569722	2000ug/mL	Restek

**<u>Note:</u>** The Part Numbers and Manufacturer listed are required per TestAmerica's 8260 VOC policy.

Restek

### 7.4 Second Source Standards

10mL FV (in Methanol)	<b>8260 Fu</b> l Final ppm:10	<b>ll List 2nd</b> 00/500		
Standard 8260 List 1/Std #1 Mogamiy	<u>Volume</u> (mL)	Part #	<u>Conc.</u>	<u>Manufacturer</u>
2 <sup>nd</sup> Source	0.5	571992.sec	2000ug/mL	Restek
2 <sup>nd</sup> Source 8260 List 1/Std #3 Gases 2 <sup>nd</sup>	0.5	569721.sec	10000ug/mL	Restek

0.5

7.4.1 Spike standards should be prepared from the same source that was used for initial calibration and should contain all reportable analytes.

569722.sec 2000ug/mL

7.4.2 Additional compounds may be added based upon project specifications.

### 8.0 <u>Sample Collection, Preservation, Shipment and Storage</u>

- 8.1 Aqueous samples should be collected in duplicate (triplicate preferably) 40ml VOA vials with Teflon lined septa and screw caps. Samples should be preserved with 1:1 HCl sufficient to lower sample pH < 2. Sample vials should be filled to overflowing with no visible head space or air bubbles. All samples should be stored refrigerated at a temperature of 4°C (+/- 2°C). Samples suspected or confirmed to contain high levels of contaminates (>1200 ppb) must be stored in a separate designated refrigerator.
- 8.2 Solid samples should be collected in 5g aliquots and placed in the appropriate sized container. Preservation should utilize methanol. Samples utilizing the Encore sampler do not require preservation but have stringent holding times as specified in Section 8.3. If sampling is conducted using EnCore samplers, the sample should be either frozen, analyzed immediately, or transferred to a 40ml VOA vial with the appropriate preservative upon receipt. If preserved, store at a temperature of 4oC (+/- 2°C).
- 8.3 Preserved VOA samples must be analyzed within 14 days of collection. Nonpreserved VOA samples must be analyzed within 7 days of collection. EnCore samples must be analyzed within 48 hours unless frozen or transferred to the appropriate preservative. Sample integrity should be monitored with both trip and holding blanks.

### 9.0 <u>Quality Control</u>

Source

- 9.1 <u>System Performance (BFB Analysis)</u>
  - 9.1.1 System performance must be demonstrated with a 50 ng injection of bromofluorobenzene (BFB) by purging. The tune is evaluated in Chrom and must meet the following criteria:

Mass	Acceptance Criteria
50	15 to 40% of m/z 95
75	30 to 60% of m/z 95
95	base peak – 100% abundance
96	5 to 9% of m/z 95
173	less than 2% of m/z 174
174	greater than 50% of m/z 95
175	5 - 9% of m/z 174
176	95 - 101% of m/z 174
177	5 - 9% of m/z 176

9.1.2 System performance, at a minimum, must be documented at the beginning of every 12-hour analytical window containing an initial calibration for method 8260D and every 12-hour analytical window prior to CCV and sample analysis for 8260C.

<u>Note:</u> When Selective Ion Monitoring (SIM) is used, there are no comparisons between spectra, and the instrument tune evaluation is not performed. Instead the instrument is optimized for the relative intensities of the pre-selected analyte's ions of interest. Before analysis of samples, the calibration verification standard will be used to update these ion ratios. Positive identification of analytes is based on retention time and the presence of the ions of interest in a ratio that matches the calibration verification standard within  $\pm 30\%$ .

### 9.2 Initial Calibration Acceptance Criteria

- 9.2.1 The minimum mean Relative Response Factors (RRFs) should be met for the compounds listed in Attachment 1. If the minimum RRF cannot be met the data is usable with sufficient proof of sensitivity (low level standard at RL).
- 9.2.2 If average response factors is used the Percent Relative Standard Deviation (%RSD) must be < 20.0%. If this cannot be achieved linear regression or quadratic calibration can be used.
- 9.2.3 If linear regression or quadratic calibration is used, the curves can't be forced through the origin. The correlation coefficient (r) for a linear model must be > 0.990 and the absolute value of the intercept must be less than the MRL. For a quadratic model, the coefficient of determination (r2) must be > 0.990. Quadratic modeling requires a minimum of six calibration points.
- 9.2.4 If linear regression is used the low level point used in calibration must be re-quantitated/re-fitted against the initial calibration. The recalculated concentration must be within 30% of the standards true concentration.
- 9.2.5 If more than 10% of the compounds included with the initial calibration exceed the 20% RSD limit and do not meet the minimum correlation coefficient (0.99) for alternate curve fits, then the chromatographic system

is considered too imprecise for analysis to begin. Adjust moisture control parameters, replace analytical trap or column, replace moisture trap or adjust desorb time, then repeat the calibration.

#### 9.3 <u>Second source calibration verification</u>

- 9.3.1 Upon completion of the initial calibration, verification must be completed by analyzing a second source calibration standard.
- 9.3.2 Allowing for sporadic marginal failures (SMF), most analytes should be within 70-130% of the expected value. For every fifteen compounds on a target analyte list, one SMF is allowed provided that the recoveries for those SMF compounds fall within 60-140% of the expected value.
- 9.3.3 If acceptance criteria are not achieved, corrective action must be taken and a new initial calibration completed.

#### 9.4 Daily Calibration Acceptance Criteria

- 9.4.1 Each of the most common target analytes should meet the minimum response factors listed in attachment 1. This is the same check performed during initial calibration. If the minimum RRF cannot be met the data is usable with sufficient proof of sensitivity (low level standard at RL).
  - 9.4.1.1 If the minimum response factors are not met, the system should be evaluated and corrective action must be taken before sample analysis begins. Possible problems include standard mixture degradation, column contamination and active sites. The check criteria must be met before sample analysis begins.
- 9.4.2 The percent difference (%D) between the initial calibration mean RRF and the continuing calibration RRF for each target analyte must < 20.0%.
  - 9.4.2.1 If the criterion is not met (i.e., greater than 20% difference or drift) for more than 20% of the compounds included in the initial calibration, then corrective action must be taken prior to the analysis of samples. In cases where compounds fail, they may still be reported as non-detects if it can be demonstrated that there was adequate sensitivity to detect the compound at the applicable quantitation limit. For situations when the failed compound is present, the concentrations must be reported as estimated values.
- 9.4.3 For 8260C, if linear regression is used the low level point used in calibration must be re quantitated/re-fitted against the initial calibration. The recalculated concentration must be within 30% of the standards true concentration.
  - 9.4.3.1 Any associated samples associated with a continuing calibration verification standard, where the response for an analyte in the verification standard is above the acceptance limit and the analyte was not detected in any of the samples analyzed in the 12-hour

window, do not need to be reanalyzed, as the verification standard has demonstrated that the analyte would have been detected if present.

- 9.4.4 If the % difference or drift exceeds the upper acceptance limit, any associated samples may be reported with qualification since the verification standard would demonstrate that the analyte would have been detected if present.
- 9.4.5 The internal standard responses and retention times (RTs) in the daily calibration check must be evaluated immediately after data acquisition. Retention times for the internal standards must be within 10 seconds from the mid-level standard in the most recent initial calibration sequence. Also, the areas of the internal standards must fall within –50 to 200% of the mid-level standard in the most recent initial calibration sequence.

### 9.5 Blanks

- 9.5.1 Method and/or instrument blanks will be considered acceptable if:
  - No contaminants are found above the RL, or
  - Contaminates are found and one of the following apply:
  - no associated analytes are found in the sample(s);
  - the contamination is less than 5% of the concentration found in the sample(s);
  - the contamination is associated with common laboratory contaminates and is < 5% of the concentration found in the sample(s) (see QAM table 12.1 for details).
- 9.5.2 If method blank failure occurs, all samples associated with the analytical batch must be reprocessed. If the samples cannot be reprocessed, the blank and all associated samples must be flagged for blank contamination.
- 9.5.3 Blank subtraction must not be applied as a correction to sample analysis.
- 9.5.4 An instrument blank analysis must be performed after the calibration standards and once for every 12-hour time period.
- 9.5.5 The method blank must be analyzed on each GC/MS system used for analysis and must be run with each analytical batch.
- 9.5.6 An instrument blank must be analyzed after any sample that has saturated ions from a given compound to check that the blank is free of interference and the system is not contaminated.
- 9.5.7 Storage or refrigerator blanks are used to monitor contamination in refrigerators used to store samples for volatile analysis. These blanks are

prepared and transferred to the appropriate refrigerators by the volatiles department personnel.

- 9.5.7.1 Storage blanks should be *prepared according to SOP SP-FLS-012* and analyzed according to *this SOP*. Any storage blank exhibiting contamination above 1/2 the *reporting limit (RL)* should immediately be brought to the attention of the QA Manager.
- 9.5.8 In all cases where blank contamination exceeds the reporting limit, a nonconformance report must be completed.

#### 9.6 Laboratory Control Sample and/or Laboratory Control Sample Duplicate

- 9.6.1 One Laboratory Control Sample (LCS) must be completed with each analytical batch. An LCS\LCSD pair may be analyzed in batches that contain samples from Alaska.
  - 9.6.1.1 Compare the percent recoveries and RPDs for the LCS and/or LCSD to the current control limits in TALS. If the %R of the LCS fails low, re-analyze it. If it still fails low, check the solutions and instrument calibration, initiate a non-conformance report and reextract and/or re-analyze the entire batch (method blank, LCS, LCSD and all samples). If the %R of the LCS fails high and there are no positive results for the target analyte(s) in the associated samples, qualify the analyte and report the results. Other sample results associated with a failing LSC or LCSD must not be reported.
  - 9.6.1.2 For projects requiring a full analyte list spike, up to four sporadic marginal failures (1 SMF per every 15 target analytes) may occur provided that no recovery is outside ±40% of the expected value.

#### 9.7 <u>Matrix Spike/Matrix Spike Duplicate</u>

- 9.7.1 One Matrix Spike/Matrix Spike Duplicate (MS/MSD) pair should be completed with each analytical batch if sufficient sample volume is available.
  - 9.7.1.1 Compare the percent recoveries and RPDs for the MS/MSD to the current control limits in TALS. If the MS/MSD %R or RPD fails, check for sample related reasons, i.e., large dilutions or high levels of target or non-target analytes.
  - 9.7.1.2 If the recoveries or RPD for the MS/MSD fail, qualify the results.

### 9.8 <u>Surrogates</u>

9.8.1 Surrogate percent recovery is monitored to assess method performance on the particular matrix. Surrogates are added to all samples, blanks, and spikes by the SAM prior to purging.

- 9.8.2 Compare the %R to the current control limits in TALS. If the %R of a surrogate in the method blank fails, re-analyze it. If it still fails, check the surrogate and internal standard spiking solutions for degradation or contamination and the instrument performance. If these steps fail to reveal a problem, reanalyze the blank. If the failing method blank is extracted, re-extract and reanalyze the blank, blank spike and all associated samples if none of the above actions solve the problem. Sample analysis cannot continue until a passing method blank is analyzed.
- 9.8.3 If a sample surrogate %R fails, check for sample related reasons, i.e., large dilutions or high levels of target or non-target analytes. If a clear reason exists for the failing parameter, initiate a non-conformance report and flag the data. If no reasonable explanation exists, re-analyze the sample. If the reanalysis of a water or low-level soil sample still fails, initiate a non-conformance report and flag the sample data. If the reanalysis of a medium level soil sample still fails, re-extract the soil sample. If the re-extracted soil sample surrogate recovery still fails, initiate a non-conformance report and flag the sample data.
- 9.9 Internal Standards
  - 9.9.1 Internal standard area counts for all sample and quality control analyses must not vary by more than a factor of two (-50% to +200%) from the associated 12 hour calibration standard.
  - 9.9.2 The retention time of the internal standard for all sample and quality control analyses must not vary more than + 10 seconds from the retention time of the associated 12 hour calibration standard.
  - 9.9.3 If these criteria are not met, the samples may need to be reanalyzed in order to determine if the anomalies are the result of matrix interference, or are instrument related. Reanalysis may not be necessary if the anomaly is observed in several samples from the same project or in samples containing high levels of petroleum hydrocarbons.

### 10.0 <u>Procedure</u>

Anomalous situations occurring during sample preparation and/or analysis must be documented on the bench sheet, and non-conformance reports must be issued if necessary. Refer to the SOP for Non-Conformances, TA-S-QAG-012.

10.1 Analysis of standards and samples is completed using a Mass Spec coupled with a purge and trap/GC sample delivery system. Recommended conditions are:

\*Purge and Trap Conditions for water and soil samples
Purge: 10.00 minutes at ambient temperature at 40 mL/minute
Dry Purge: 0
Desorb: 1.0 minutes at 190°C
Trap Bake: 7.00 minutes at 210°C
Valve: 110°C
Transfer and external lines: 110°C

### \*Gas Chromatograph Conditions

Column:	narrow bore
Temp 1:	45°C
Hold 1:	1.50 minutes
Rate 1:	10°C per minute
Temp 2:	100°C
Hold 2:	0
Rate 2:	20°C per minute
Temp 3:	240°C
Hold 3:	3.50 minutes
Injector Temperature:	250°C
Mass Spectrometer Temp:	280°C
Column head pressure:	23-85psi
Column flow rate:	1.00 ml/min

\*Operating Conditions for Mass Spectrometer

Mass range:	35 - 270 amu
Scan time:	0.6 - 2 sec/scan; at least 5 spectra/peak
Source temp:	Per Manufacturer

\*Note: These conditions can vary by instrument. This is only a guideline.

#### 10.2 Initial Calibration

Initial calibration must be performed prior to sample analysis or upon failure to achieve continuing calibration acceptance criteria. The initial calibration must be analyzed within 12 hours of the associated instrument performance check (BFB).

An initial calibration may be completed as needed (continuing calibration criteria can not be met), after a source cleaning and/or column change, or any time a major repair or change has occurred with the instrument that affects calibration.

- 10.2.1 Prior to any initial calibration, confirm that the GC/MSD is stable and equilibrated. Re-tune the mass spec if necessary (see manual for instructions).
  - 10.2.1.1 If at all possible, allow the instrument to equilibrate overnight at all operating temperatures if the source/column has been cleaned/changed.
  - 10.2.1.2 Check the background of air/water levels and base ion by scanning for appropriate ions and also visually inspecting the spectrum scan for any other possible and undesirable background.
  - 10.2.1.3 Recheck the multiplier settings; after a source is cleaned the EM can most often be dropped.

#### 10.2.2 Initial Calibration Levels

- 10.2.2.1 All volatile target compounds are analyzed at a minimum of five (5) concentrations in order to document the linearity of the instrument. (Note: quadratic modeling requires a minimum of six calibration points). The lowest calibration level must be at or below the established MRL and the highest calibration must encompass the expected analytical range. The remaining calibration standards must be evenly spaced between the lowest and highest standards. Initial calibration must be performed prior to sample analysis or upon failure to achieve continuing calibration acceptance criteria. The initial calibration must be analyzed within 12 hours of the associated instrument performance check (BFB).
- 10.2.2.2 Only the highest or lowest calibration points may be rejected because of non-linearity. Rejection of such a point may affect the reporting limit or the linear range. Points within the curve may not be rejected, unless an obvious reason is apparent (e.g., misinjection). An entire calibration level may be rejected for a valid analytical reason. The reason for the rejection must be documented on the raw data and the data for the rejected level must be included with the initial calibration raw data.
- 10.2.3 Use the Chrom data system to setup and calculate the calibration curves. Acceptance criteria for the initial calibration are summarized in Section 9.2.
- 10.2.4 Selection of internal standard should permit most of the components of interest in a chromatogram to have retention times of 0.80-1.20, relative to one of the internal standards.
- 10.2.5 The initial calibration is verified by analyzing a second source calibration standard (section 7.4). Acceptance criteria for the second source standard are summarized in Section 9.3.

### 10.3 Retention Time (RT) Windows

- 10.3.1 Using data obtained from three analyses over a 72 hour period of a calibration verification (or mid-point) standard, record the retention time for each analyte and surrogate to three decimal places (e.g., 0.007).
- 10.3.2 Calculate the mean retention time and standard deviation for each analyte and surrogate.
- 10.3.3 Assign a retention time window of +3 standard deviations around the mean for each analyte.
- 10.3.4 If the standard deviation is 0.00, use a default retention time window of 0.03 minutes.
- 10.3.5 RT window calculations are saved with the quantitation method in Chrom. New RT windows must be established when a new GC column is installed.

- 10.3.6 Establish the center of the retention time window for each analyte and surrogate by using the absolute retention time for each analyte and surrogate from the calibration verification standard at the beginning of the analytical shift (9.3). For samples analyzed during the same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration.
- 10.3.7 Whenever the observed retention time of a surrogate in a continuing calibration verification standard is outside of the established retention time window, the analyst should determine the cause and correct the problem before proceeding with the analyses.

#### 10.4 Calibration Verification

- 10.4.1 A continuing calibration standard, containing all analytes of interest, is analyzed at the beginning of each 12-hour analysis period prior to the analysis of the method blank and samples.
- 10.4.2 All compounds must meet the requirements documented in Section 9.4.
- 10.4.3 Calibration verification, at a minimum, must be documented at the beginning of every 12-hour window. If continuing calibration cannot be met, either new standards and/or a new calibration are needed.
- 10.4.4 All internal standard areas and retention times are assessed immediately after calibration. Areas and times compared to the mid point of the initial calibration. Internal standard areas should not deviate by a factor of two and the retention times should not deviate by > 30 s. If either situation occurs, appropriate action is taken and the standard re-analyzed. All corrective action and return to control are documented in the Corrective Action section in the analysis logbook for the appropriate instrument.

#### 10.5 Water Sample Analysis

**Note** Prior to analysis, invert the sample vials and inspect them for air bubbles >4mL. Note any vials containing headspace on the bench sheet. If any are noted, scan and attach the bench sheet to the analytical batch in TALS.

Immediately after analysis, the analyst must check the pH of aqueous samples with pH paper to ensure that the pH <2. Record the pH of aqueous samples on the bench sheet and/or run log. In those cases where the pH >2 and the sample was analyzed outside of the 7-day hold time, initiate a non-conformance report and qualify the data.

- 10.5.1 Load the 40 ml voas directly onto the autosampler tray and set the sequence to the desired tray location.
- 10.5.2 The SAM (Standards Addition Module) automatically adds surrogate and internal standard directly to the 5ml aliquot that is purged.

- 10.5.3 Purge and analyze the sample(s) according to the specifications documented in Sections 10.1.
- 10.5.4 8260C and 8260D MS/MSD: For the matrix spike and matrix spike duplicate, add 4.3ul of the 8260 full list solution prepared in section 7.3 directly to the 40ml voa labeled MS/MSD.
- 10.5.5 8260C and 8260D LCS/LCSD: Add 5ul of the 8260 full list solution prepared in section 7.3 to a 50ml volumetric filled to volume with di water. Cap and invert the flask one time. Slowly pour the contents to a clean 40ml vial and cap. Because the preparation is identical, the CCV may be replicated as the LCS by checking the appropriate box in the Chrom worklist.

#### 10.6 Diluted Analysis

- 10.6.1 If the concentration of a target compound in a sample exceeds the concentration (of the compound) in the highest calibration standard, the sample must be diluted.
- 10.6.2 Over-fill a clean 40 ml voa to 43mL. Remove the appropriate amount of water to achieve the desired dilution and replace it with an equivalent volume of sample.
- 10.6.3 Analyze the diluted sample utilizing the same parameters used for the initial calibration and calibration verification.

#### 10.7 Medium Level Soil and Product Analysis

- 10.7.1 Remove samples from storage.
- 10.7.2 Verify the balance calibration and fill out balance logbook. Verify the autopipette volume using methanol and record the results in the designated spreadsheet.
- 10.7.3 Soil samples are preserved in the field by adding soil to a pre-weighed container with methanol. Use the TALS prep batch worksheet to calculate the initial volume of the samples. Enter "yes" in the cell corresponding with the row of the sample and the "Subtract MeOH Weight" column of the worksheet tab for samples with tare weights that do not account for the methanol weight (e.g. Alaskan samples). Enter "no" for containers in which the methanol is added before the container is tared (eg 5mL MeOH voas).
- 10.7.4 Five grams of soil (or waste/other matrix) can be added to a voa vial containing 5 mls of methanol if a field preserved sample is unavailable. Record the weight to the nearest 100th of a gram. Samples not field preserved must be qualified as such.
- 10.7.5 Determine if a client specified any samples for site-specific QC (matrix spike and matrix spike duplicate). If not, choose a random sample with

enough methanol for three 860mL aliquots plus one more in case reextraction is required.

- 10.7.6 For the blank and *laboratory control spike (LCS)* use a clean 40ml voa with 5 ml of methanol. Sand may be used as a blank matrix.
  - 10.7.6.1 <u>8260</u> laboratory control spikes: Label unpreserved, 40mL methanol voa vials with the appropriate QC sample IDs. Add 5g clean sand and 5mL MeOH to each. Add 25uL of the 8260 full list solution prepared in Section 7.3 directly to the methanol in the voa vials labeled LCS and LCSD (if analyzed). Record the spike IDs on the bench sheet.
  - 10.7.6.2 <u>8260 matrix spikes</u>: Add *4.3uL* of the 8260 full list solution prepared in Section 7.3 directly *through the septum of* the client sample voa vial designated as MS or MSD *that has been prepared as below (10.7.9).* Record the spike IDs on the bench sheet.
- 10.7.7 Vortex or shake for 2 minutes and sonicate.
- 10.7.8 Centrifuge the vials until a clear layer of methanol is apparent (if necessary).
- 10.7.9 Dilute the MeOH from each sample 50x with purged DIW. This may be accomplished by adding 860mL sample MeOH to 42.14 mL DIW in a VOA vial.
- 10.7.10 Dilutions, when necessary, are done by using less than the normal 860 uL of MeOH extract. If less than 100 uL of MeOH extract is used, the difference must be made up with purge and trap grade MeOH in order to maintain matrix. If necessary, serial dilutions can be performed for samples of very high concentration. Record the dilution volume and dilution factor.
- 10.7.11 Samples that require re-analysis for IS, surrogate, dilutions, or carry-over may be analyzed in subsequent runs without re-analysis of accompanying QC samples. However, in addition to the passing tune and CCV criteria, a CCB must be analyzed to demonstrate that the system is free of contamination.

#### 11.0 Corrective Actions

- 11.1 Listed below are steps that must be taken when an out-of-control situation occurs:
  - 11.1.1 demonstrate that all the problems creating the out-of-control situation were addressed
  - 11.1.2 document the problem and the action which was taken to correct the problem in an Non-conformance Memo (NCM) in TALS.
- 11.1.3 document in the NCM that an in-control situation has been achieved and receive approval of the supervisor, QA Manager or the Laboratory Director prior to the release of any analytical data associated with the problem.
- 11.2 Discussed below are the suggested and required courses of action when an out-ofcontrol situation has occurred.
  - 11.2.1 BFB Criteria
    - 11.2.1.1 If BFB criteria can not be met, determine if the source of the problem is instrumental or tune related. Inspect overall sensitivity, possible excessive background, the proportionality of the masses, relative abundances of the target masses. If it seems tune-related, adjust the tune parameters in Manual Tune slightly, until acceptance is achieved. If the problem seems instrumental, perform suggested trouble-shooting to locate and correct the problem (Suggestions can be found in most of the manuals). NO analysis can proceed until criteria are met.
  - 11.2.2 Initial Calibration
    - 11.2.2.1 If initial calibration can not be met, determine if the problem is analytical or instrumental. Some suggested questions to ask would be:
      - were the standards prepared correctly?
      - was the proper amount analyzed?
      - check the chromatogram did something happen on one or two analyses; i.e., a leak
      - check the response factors is one concentration level very high or low? re-analyze
      - o how old are the standards?
    - 11.2.2.2 All calibration criteria must be met (Section 11.2). If the ICAL does not meet specified criteria, at minimum, the appropriate levels must be re-analyzed. If necessary, new standards should be prepared and the levels re-analyzed. During analysis of an initial calibration, documentation of the re-analyses of specific levels is not required. See previous section outlining CA for minimum COD values as well. Refer to the TestAmerica Corporate Policy, CA-T-P-002, Selection of Calibration Points, for further guidance.

#### 11.2.3 Continuing Calibration

- 11.2.3.1 If continuing calibration can not be met, determine if the problem is analytical or instrumental. Some suggestions:
  - o check the chromatography
  - is overall sensitivity low?
  - excessive background?
  - o how old is the standard?

- o need a new 5-point?
- o has the tune shifted?
- 11.2.3.2 Compare the relative abundances of 69, 131 and 219 from that day's manual tune to those on the day the initial calibration was analyzed. Slight adjustments to the tune may bring the standard in. Certain compounds will help indicate what the problem is.
- 11.2.3.3 All calibration criteria must be met (Section 9.2). If the CCAL does not meet specified criteria, at minimum the standard should be reanalyzed. A new standard may be prepared and then re-analyzed. If necessary, a new ICAL must be run. All corrective action taken for CCAL's must be recorded on an NCM.

### 11.2.4 Method Blank (MB)

- 11.2.4.1 If the MB is/appears to be contaminated, re-analyze. If contamination is still present, the problem may be in one of the common elements, such as the trap, transfer line, port valve or column. Baking the trap/column and running position blanks may be necessary. If contamination has occurred beyond that, and maintenance is required (i.e., replace trap) it is documented in the Maintenance logbook. All corrective action taken for Method Blanks must be recorded on an NCM. <u>Under extenuating circumstances</u>, if analysis continues, qualification must be made as to the positive hits above the RL for the compounds in question. Any associated samples analyzed in the tune must be noted. Any samples containing positive hits must be re-analyzed (i.e., past hold-time), the positive hits are flagged with "B" and the situation and data noted and qualified in a case narrative and/or Non-Conformance Memo (NCM).
- 11.2.5 Surrogates
  - 11.2.5.1 All surrogate recoveries are calculated. If ANY surrogates are outside limits in the MB, it must be re-analyzed. Analyses CAN NOT proceed until an in-control situation is demonstrated. Re-analyze the blank. If surrogates are still out, the instrument may need to be re-tuned (BFB) and/or another calibration standard analyzed. If the problem persists, further maintenance action may be required (i.e., trap replacement, clean instrument).
  - 11.2.5.2 Before pursuing other measures, check to be sure that:
    - o calculations are correct
    - concentrations of the surrogates in the spiking solution are correct
    - the correct amount of IS/SS solution was added
    - IS/SS areas are reasonable

- 11.2.5.3 If any surrogates in a sample are outside limits, check the above first. Any sample that has a surrogate out must be re-analyzed. The re-analysis can take the form of a dilution, if there is reasonable expectation that a high concentration of a target compound is causing a matrix effect. If the surrogate(s) is/are still outside limits, a matrix effect is demonstrated and both reports are submitted. Depending on the client, the best result may be reported and the other result narrated. If all surrogates are in-control on the re-analysis, only the second analysis is reported.
- 11.2.5.4 Every effort is made to complete the re-analysis within hold-time. If this is impossible (i.e., capacity hold-times preclude re-analyses within hold-time), both reports may be submitted. This is documented in the narrative.
- 11.2.5.5 If the sample with the out-of-control surrogates is the same sample on which the MS and MSD were performed, and the pattern is duplicated, then re-analysis is NOT required. Documentation of the similarities is required.
- 11.2.5.6 Surrogate corrective action is documented on the sample tracking form for samples.

#### 11.2.6 Laboratory Control Sample (LCS)

- 11.2.6.1 All reported compounds are spiked. Acceptance limits are controlcharted by matrix and method and can be found in TALS. If reported analytes fail the acceptance criteria the LCS samples may be re-analyzed, or the spike solution and standard may be verified for correct concentrations and new spike solutions may be prepared. All corrective action and return to control must be documented at the time with an NCM.
- 11.2.6.2 If the recoveries are low, in general another LCS may be reanalyzed. If recoveries are high, affected samples may be qualified and reported if they are non-detect for the failing compound. However, no corrective action is absolutely required by the bench unless an error is discovered. The recoveries may or may not be documented in a NCM, however, they are recorded in TALS.

### 11.2.7 Matrix Spikes (MS)

- 11.2.7.1 Acceptance limits for MS/MSD samples are control-charted by matrix and method. Limits can be found in TALS.
- 11.2.7.2 If recoveries are outside limits, the LCS is reviewed for those compounds. If the recoveries are within limits in the associated LCS samples, no further action is required. See above section concerning LCS corrective action for further information and action required for recoveries outside limits in LCS samples. Corrective action and required documentation apply.

### 11.2.8 Internal Standard Policy

11.2.8.1 Method 8260 does not require re-analyses of samples for low internal standard areas. However, it is TestAmerica's policy to monitor areas and retention times, therefore, the following guidelines apply.

#### 11.2.8.1.1 Situations requiring re-analyses :

- o If ALL areas are outside limits the sample will be re-analyzed.
- Any sample that has a positive hit associated with any internal standard outside limits will be re-analyzed.

#### 11.2.8.1.2 Situations NOT requiring re-analyses :

- If all surrogates are within limits and there are no positive hits associated with those internal that are outside limits, the sample does not have to be re-analyzed. Situation should be addressed in an NCM.
- If all surrogates are within limits, but there is an obvious matrix effect occurring, even if positive hits are noted, the sample does not need to be re-analyzed. This decision will be approved by the supervisor. The situation should be addressed in an NCM.
- If there is historical evidence that shows a repeated pattern for a certain client and site, and this can be documented by reviewing past projects, the samples do not have to be reanalyzed. This decision will be approved by the supervisor and documented in an NCM.
- 11.2.8.2 Any sample showing retention times outside windows will be reanalyzed. This is documented in the appropriate manner as in the preceding paragraph.

**Note:** Anomalous situations occurring during sample preparation or analysis should be documented on the bench sheet and non-conformance reports should be issued, if necessary. Possible anomalous situations resulting in non-conformance reports include loss of a sample or batch QC through spillage or breakage.

### 12.0 Calculation and Data Reduction

### 12.1 Quantitation of Target Analytes

12.1.1 Analytes that meet the identification criteria described in Section 12.2 are quantitated by the internal standard method against the calibration curve established in Section 9.2 (see equations 12.6). The EICP area of the primary characteristic ion is used for quantitation. The average RRF or

appropriate regression equation from the initial calibration is used to calculate the concentration in the sample.

- 12.1.2 Analytes that have a calculated concentration exceeding the highest calibration standard must be diluted or re-prepared and re-analyzed.
- 12.1.3 Analytes that have a calculated concentration below the lower calibration limit but above the method detection limit must be reported and flagged with the "J" qualifier. (Note: Values below the MRL are qualitative only and are not legally defensible.)
- 12.1.4 Analytes that have a calculated concentration below the method detection limit must not be reported.

#### 12.2 Compound Identification

Qualitative identification of compounds determined by this method is based on retention time and on comparison of the sample mass spectrum, after background correction, with characteristic ions in a reference mass spectrum. The reference mass spectrum must be generated using the conditions of this method on the same instrument used for sample analysis. The characteristic ions from the reference mass spectrum are defined as the three ions of greatest relative intensity, or any ions >30% relative intensity, if less than three such ions occur in the reference spectrum. Compounds are identified when the following criteria are met:

- 12.2.1 The characteristic masses of each parameter of interest must maximize in the same or within one scan of each other. Selection of a peak by a data system target compound search routine, such as that employed by Chrom, meets this criteria.
- 12.2.2 Relative retention times (RRT) must be within ±0.06 RRT units of the RRT established by the continuing calibration.
- 12.2.3 Relative intensities of the ions should agree within ±30% between the standard and sample mass spectrum.
- 12.2.4 Structural isomers that have very similar mass spectra and less than 30 seconds difference in retention time, can be explicitly identified only if the isomers in a standard mix are completely resolved (i.e., the baseline to valley height between the isomers is less than 25% of the sum of the two peak heights). Otherwise, structural isomers are identified as isomeric pairs.
- 12.2.5 lons present at > 10% in the sample mass spectrum but not present in the standard mass spectrum must be reviewed.

\*\*\*<u>Note:</u> 1,4-dichloro-2-Butene co-elutes with 1,2,3-trichloropropane. The primary and secondary quantitation ions 75 and 76 respectively for 1,2,3-trichloropropane can also be found in 1,4-dichloro-2-Butene leading to possible misidentification problems. Caution is advised when reviewing these analytes for reporting and close attention should be paid to the other available ions for identification. \*\*\*

### 12.3 Tentatively Identified Compounds

- 12.3.1 Chromatographic peaks in volatile fraction analyses that are not target compounds, performance compounds, or internal standards are possible candidates for tentatively identified compounds (TIC). The following guidelines should be applied for identification of possible TICs when comparing the sample spectrum with the nearest library search. Of the possible compounds generated by these guidelines, the top 20 should be reported.
- 12.3.2 Chromatographic peaks considered for TIC should have an area > 10% of the nearest internal standard area.
- 12.3.3 Major ions (> 10% relative intensity) in the reference spectrum should be present in the sample spectrum.
- 12.3.4 The relative intensities of the major ions should agree within + 20% between the sample and the reference spectra.
- 12.3.5 Molecular ions present in the reference spectrum should be present in the sample spectrum.
- 12.3.6 If in the analyst's judgment uncertainty or outside factors impact identification, the TIC may be reported as "Unknown".

### 12.4 Manual Integrations

- 12.4.1 Manual integrations should be employed only in situations where the data system has:
  - incorrectly identified a signal, or
  - incorrectly quantitated a signal thereby producing an obvious bias.
  - Refer to CA-Q-S-002 for specifics on manual integration.

### 12.5 Data Review

12.5.1 Upon completion of the analytical run, the primary analyst must review all data for compliance with criteria documented above, acknowledge any Data Review Checker (DRC) findings in TALS, and document the review on the data review checklist in DRC.

12.5.2 Upon completion of the primary review, the Department Supervisor (or designate) must perform a secondary peer review (see SP-QAG-023). The secondary reviewer completes the remaining items on the DRC checklist.

### 12.6 Calculations / Data Reduction

### **Response Factor**

RF = (Ax \* Cis) / (Ais \* Cx)

where: Ax = area of the characteristic ion for the compound of interest Ais = area of characteristic ion for the specific internal standard Cis = Concentration of the specific internal standard Cx = Concentration of the compound of interest

### Percent Relative Standard Deviation (RSD)

%RSD = (SD / X) \* 100

where: SD = Standard deviation of average RFs for a given compound X = Mean value of 5 RFs for respective compound

### **Daily Calibration RF % Difference**

% Difference = (|RFi - RFc| / RFi) \* 100

where: RFi = Response factor established during initial calibration RFc= Response factor established during continuing calibration

## **Analyte Concentration, Water Samples**

Conc (ug/L) = (Ax \* Qis) \* D / (Ais \* RFi \* V)

where: Ax = Area of characteristic ion of compound being measuredQis = Quantity of appropriate internal standardAis = Area of characteristic ion of appropriate internal standardRFi = Response factor of compound being measured (mean value based on the initialcalibration).V = Sample amount

D = Dilution Factor

### Analyte Concentration, Soil Samples

Conc (ug/L) = (Ax \* Qis) \*  $V_t$  / (Ais \* RFi \*  $V_i$  \*  $W_s$ \*D)

where: Ax = Area of characteristic ion of compound being measured

Qis = Quantity of appropriate internal standard

Ais = Area of characteristic ion of appropriate internal standard

RFi = Response factor of compound being measured (mean value based on the initial cal).

 $V_t$  = Volume of total extract

 $V_i$  = Volume of extract added for purging  $W_s$  = weight of sample extracted or purged D = % dry weight of sample/100

### Spike Recovery

% Recovery = (Conc. Found / Conc. Expected) \* 100

### **Relative Percent Difference**

RPD = (| X1-X2 | / ((X1+X2)/2)) \* 100

where: RPD = Relative Percent Difference

X1 = Primary value

X2 = Duplicate value

### **Moisture Determination for Soils**

Since all results are reported on a dry-weight basis the percentage moisture must be determined. Thus a separate, unpreserved jar of the same sample must accompany the methanol-immersed sample. To determine the percentage moisture, follow TA-S-SPL-003.

### 13.0 <u>Method Performance</u>

### 13.1 Method Detection Limit Study (MDL)

**13.1.1** The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure in the QA Manual. MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency or whenever there is a significant change in instrumentation or analytical methodology (see SP-QAG-010).

### 13.2 Demonstration of Capabilities

- 13.2.1 An initial demonstration of capability shall be performed before a new instrument or analytical method is brought into production.
- 13.2.2 Initial demonstrations of capability and annual demonstrations of capability or passing annual PE results are required for each analyst.

### 13.3 <u>Training Requirements</u>

13.3.1 See SP-QAG-26 for general training requirements.

### 14.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention."

### 15.0 <u>Waste Management</u>

All waste will be disposed of in accordance with Federal, State and Local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this method and the policies in section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention."

#### 15.1 <u>Waste Streams Produced by the Method</u>

- 15.1.1 Waste disposal procedures are incorporated by reference to SP-SPL-006. The following waste streams are produced when this method is carried out:
- 15.1.2 Aqueous waste generated from analysis. This material may have a pH of less than 2.0. This material is collected in a 5 gallon or smaller container. Samples containing hazardous levels of analyte are separated and stored in the sample archive room until they are bulk packed in a barrel for disposal. All other material is neutralized with baking soda and purged over night (at least 12 hours). After purging the waste can be disposed via the sanitary sewer.
- 15.1.3 Solvent waste generated from analysis. All solvent waste is collected in a satellite container located at the volatiles sample prep station. This waste is bulked into the flammable waste barrel as needed.
- 15.1.4 Solid waste generated from analysis. The solvent is removed from the 5035 containers and collected as solvent waste mentioned above. The containers are evaporated in a hood over night (at least 12 hours) before being discarded.
- 15.1.5 Expired Standards. Expired standards are collected in a satellite container and bulked into the standard drum as needed.

#### 16.0 <u>References / Cross-References</u>

- 16.1 TestAmerica Quality Assurance Manual
- 16.2 TestAmerica Health & Safety Manual
- 16.3 US EPA Method 8260C, "Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry", SW-846, Rev.3, August 2006.

- 16.4 US EPA Method 8260D, "Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry", SW-846, Update VI, June 2018.
- 16.5 US EPA Method 8000C, "Determinative Chromatographic Separations", SW-846, Rev. 3, 2003.
- 16.6 CA-Q-S-006, Detection Limits.
- 16.7 CA-Q-S-002, Acceptable Manual Integration Practices.
- 16.8 SP-QAG-026, Basic Employee Training.
- 16.9 SP-QAG-023, Data Review and Reporting of Analytical Results.
- 16.10 SP-FLS-012, Fridge Blanks.
- 16.11 SP-SPL-003, Percent Solids.

### 17.0 Method Modifications

NA

### 18.0 Attachments

18.1 Attachment 1: Minimum RRF's

### 19.0 <u>Revision History</u>

Revision 3, dated 29 August 2007

### Revision 4, dated 3 February 2010

• General procedure update.

## Revision 5, dated 21 March 2012

- Updated method from 8260B to 8260C
- Changed auto sampler information and sample prep steps to include voas.
- Updated standard hold times to 6 months and 1 week for gases once injector vial w/ insert has been used.
- Removed references to CCC and SPCC and replaced with standard 20% RSD and minimum RRF for selected compounds.
- Added attachment 2: Calibration QCAR
- Added attachment 3: Minimum RRF requirements

## Revision 7, dated 24 March 2016

- Removed reference to calibration being conducted every 12 hours, section 2.0
- Updated Enviroquant with Chrom, sections 6.1.5, 10.6.5 and 10.12.2
- Updated Element LIMS with TALS, throughout.
- Updated Part #'s, sections 7.3 and 7.4
- Updated CAR with NCM, throughout

- Updated section 9.9.6 and 9.9.7 to current practice
- Updated where RT window calculations are stored, section 10.6.5
- Updated where soil sample initial volumes are calculated, section 10.9.3
- Added reanalysis for IS failure details, section 10.9.13
- Replaced QCAR with review checklist, section 10.16.1 and 10.16.2
- Updated section 15.0
- Updated Attachment 1 and 2
- Updated MSDS to SDS

### Revision 8, dated 20 March 2017

- Updated to Chrom, section 10.4
- Added note regarding SIM analysis, section 10.4
- Updated to Data Review Checker, sections 10.16.1 and 10.16.2
- Removed attachments 1 and 2, no longer needed with implementation of DRC.

### Revision 9, dated 20 May 2019

- Updated logo and copyright information
- Added 8260D reference to summary of method, section 2
- Updated second source standards to reflect current practice, section 8.4
- Updated quality control, section 10
- Updated procedure to reflect current practice, section 11
- Fixed numbering and formatting errors

### Revision 10, dated 13 June 2019

- Corrected additional numbering and formatting errors
- Updated language in section 5.0 to required language
- Clarified criteria for the Tune, section 9.1.2
- Updated procedures for MS/MSD preparation and spiking, sections 10.7.5 and 10.7.6.2
- Added reference for 8260D, section 16.0

Name	Minimum RF
Dichlorodifluoromethane	0.1
Chloromethane	0.1
Vinyl Chloride	0.1
Bromomethane	0.1
Chloroethane	0.1
Trichlorofluoromethane	0.1
1,1 Dichloroethene	0.1
Carbon Disulfide	0.1
Methylene Chloride	0.1
Acetone	0.1
trans-1,2-Dichloroethene	0.1
methyl-t-butyl ether	0.1
1,1-Dichloroethane	0.2
cis-1,2-Dichloroethene	0.1
Chloroform	0.2
Carbon Tetrachloride	0.1
1,1,1-Trichloroethane	0.1
2-Butanone	0.1
Benzene	0.5
1,2-Dichloroethane	0.1
Trichloroethene	0.2
1,2-Dichloropropane	0.1
Bromodichloromethane	0.2

# Attachment 1: Recommended Minimum RRF's

Name	Minimum RF
cis-1,3-Dichloropropene	0.2
Toluene	0.4
4-Methyl-2-Pentanone	0.1
trans-1,3-Dichloropropene	0.1
Tetrachloroethene	0.2
1,1,2-Trichloroethane	0.1
Dibromochloromethane	0.1
1,2-Dibromoethane	0.1
2-Hexanone	0.1
Ethylbenzene	0.1
Chlorobenzene	0.5
m,p-Xylene	0.1
o-Xylene	0.3
Styrene	0.3
Bromoform	0.1
Isopropylbenzene	0.1
1,1,2,2-Tetrachloroethane	0.3
1,3-Dichlorobenzene	0.6
1,4-Dichlorobenzene	0.5
1,2-Dichlorobenzene	0.4
1,2-dibromo-3-chloropropane	0.05
1,2,4-Trichlorobenzene	0.2



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# Percent Solids CLP SOW ILM05.4 Exhibit D Section 1.6

Approvals (Signature/Date):			
Randee Arrington Laboratory Director	Date	Terri Torres Quality Assurance Manager	Date

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### 1.0 Scope and Application

### 1.1 Analytes, Matrix(s), and Reporting Limits

This method is used to analyze sediment, soil and sludge samples for total solids content. The results of this analysis may be reported to clients. Additionally, results of this analysis may be used in the reporting of analytical results adjusted on dry weight basis. Current reporting limits may be found in the *laboratory information management system (TALS)*.

On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in the Quality Assurance Manual.

#### 2.0 <u>Summary of Method</u>

An initial mass of the sample is evaporated in a weighed dish. The sample is dried in an oven at  $105 \pm 3^{\circ}$ C and a final weight is determined. A percent solid may then be determined.

#### 3.0 <u>Definitions</u>

**3.1** Batch: A group of 20 or less samples prepared and/or processed together.

#### 4.0 Interferences

If the sample has a highly irregular matrix, analysis of dry weight may not be applicable. Analysts should consult a supervisor to determine if the analysis is feasible.

#### 5.0 Safety

Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual, the facility addendum to the CSM, and this document.

#### 5.1 Specific Safety Concerns or Requirements

There are no specialized safety concerns associated with this method.

#### 5.2 Primary Materials Used

There are no materials used in this method that have a serious or significant hazard rating. **NOTE: This list does not include all materials used in the method.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the SDS for each material before using it for the first time or when there are major changes to the SDS.

Material	Hazards	Exposure Limit (1)	Signs and symptoms of exposure
None	NA	NA	NA
1 – Exposure limit refers to the OSHA regulatory exposure limit.			

### 6.0 Equipment and Supplies

6.1 Instrumentation None

### 6.2 Supplies

- **6.2.1** Top Loading Balance (Accurate to 0.01g)
- **6.2.2** Drying Oven with NIST thermometer (or standardized against NIST thermometer) capable of reaching 105°C (±3°C)
- 6.2.3 NIST traceable Class 1 weights
- 6.2.4 Aluminum weighing boats
- 6.2.5 Wooden tongue depressors
- 6.2.6 Balance calibration checks logbook

#### 7.0 <u>Reagents and Standards</u> None

#### 8.0 <u>Sample Collection, Preservation, Shipment and Storage</u>

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time
Soils	4 oz. glass jar	20 grams	Cool 4 ± 2° C	28 Days

#### 9.0 <u>Quality Control</u>

**9.1 Sample QC** - The following quality control samples are prepared with each batch of samples.

Quality Controls	Frequency	Control Limit
Sample Duplicate (DUP)	1 in 20 samples	Statistical Limits <sup>1</sup>
1		

<sup>1</sup> Statistical control limits are updated annually and are updated into LIMS.

- **9.1.1** If the Sample Duplicate RPD is greater than the limit, check to be sure that there are no errors in calculations.
- **9.1.2** Refer to SP-QAG-012 for non-conformances and corrective action reports.
- 9.1.3 Instrument QC Not applicable.
- 10.0 <u>Procedure</u>
- 10.1 Calibration

**10.1.1** The analytical balance should be checked and recorded on each day of use with NIST traceable Class 1 weights.

### **10.2** Sample Preparation

- **10.2.1** Write the sample number of the sample to be analyzed on an aluminum dish. *Place the dish on the pre-tared balance and record the dish weight in the" Dish weight" column of the TALs moisture batch, under the worksheet Tab. The balance should have a print function button that will automatically enter the weight into the cell highlighted in the worksheet tab.*
- **10.2.2** Weigh approximately 10 g of *homogenized* sample into the weigh boat/dish. Record the combined weight of the wet sample and dish in the "SampleMassWet" column of the TALs worksheet. The balance should have a print function button that will automatically enter the weight into the cell highlighted in the worksheet tab.
- **10.2.3** Place the weighed sample into a  $105^{\circ} \pm 3^{\circ}$ C oven for a minimum of 4 hours (see section 103 for the expedited procedure). Record the temperature of the oven at this time and the date and time the sample(s) were placed in the oven *in the batch information section of the TALS batch. If you right click anywhere in the batch the first toggle down option says "View Batch Information". Select and fill out the start and end times here as well as all batch information.* Samples left in the oven for 12 to 24 hours are assumed to be dry and at a constant weight.
- **10.2.4** Record the *date*, time, *and corrected oven temperature* when removing the samples from the drying oven. Allow sample(s) to cool for a minimum of 15 minutes and a maximum of 45 minutes. Sample(s) that are removed from the drying oven and exposed to ambient conditions for greater than 45 minutes must be placed in a desiccator to prevent moisture contamination.
- **10.2.5** Weigh the dry sample and dish on the pre-tared balance and record the value in the "SampleMassDry" TALS worksheet column. Recalculate the Duplicate in the batch if you do not see RPD results.

#### **10.3 Expedited Procedure**

- **10.3.1** If the sample must be processed on an expedited basis, the sample must be dried in a  $105^{\circ} \pm 3^{\circ}$ C drying oven for a minimum of 4 hours. Constant weight should not be assumed and should be proven as follows:
- **10.3.1.1** Constant weight is proven when the different weights of a sample from replicate weighing do not vary by more than 0.01g. Sample(s) must be placed back in the oven for a minimum of one hour prior to replicate weighing. The process must continue until a constant weight is observed.

#### 10.4 Data Review

**10.4.1** Upon completion of the analytical run, the primary analyst must review all data for compliance.

**10.4.2** Upon completion of the primary review, the Department Supervisor (or designate) must perform a secondary peer review (see SP-QAG-023).

## 11.0 Calculations / Data Reduction

### 11.1 Total Percent Solids

 $TotalPercentSolids = \left(\frac{Weight of dried sample}{Weight of wet sample}\right) \times 100$ 

### 12.0 <u>Method Performance</u>

- 12.1 Method Detection Limit Study (MDL) Not required.
- **12.2 Demonstration of Capabilities** Not required.

## 12.3 Training Requirements

See SP-QAG-026 for general training requirements.

### 13.0 <u>Pollution Control</u>

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention."

#### 14.0 Waste Management

All waste will be disposed of in accordance with Federal, State and Local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this method and the policies in section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention." Waste Streams Produced by the Method:

There are no special waste streams associated with this method.

#### 15.0 <u>References / Cross-References</u>

- **15.1** TestAmerica Quality Assurance Manual
- **15.2** TestAmerica Health & Safety Manual
- **15.3** Contract Laboratory Program SOW ILM 05.4 Exhibit D, Section 1. Nov 2005.
- **15.4** SP-QAG-012, Non-Conformances : Data Qualifiers, NCRs, CARs, Case Narratives, and Root Cause Investigations
- **15.5** SP-QAG-026, Basic Employee Training

- **15.6** SP-SPL-006, Sample Disposal
- 15.7 SP-QAG-023, Data Review and Reporting of Analytical Results
- 16.0 <u>Method Modifications</u> None
- 17.0 <u>Attachments</u> None

### 18.0 <u>Revision History</u>

Revision 3: 9/14/06

Reasons for Change, Revision 4:

- Annual Review:
- Updated format
- Added sample duplicate

Revision 5: 1/25/11 General review, no major changes.

Revision 6: 1/28/13 Biannual review, no changes.

Revision 7: 01/20/16

- Updated from Element to TALS
- Included autofunction of sending balance values to the computer without hand entering.

Revision 7.1: 01/15/20

- Updated emblem and copyright
- Updated approvers

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Environment Testing TestAmerica

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Seattle

## Title: Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) [Methods 6020, 6020A, 6020B, 200.8]

Approvals			
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### 1.0 <u>Scope and Application</u>

- **1.1** This procedure describes multi-elemental analysis by inductively coupled plasma-mass spectrometry (ICP/MS) based on EPA Methods 200.8, 6020 and 6020B.
- **1.2** Method 200.8 lists twenty-one elements approved for analysis by ICP/MS (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Hg, Mo, Ni, Se, Ag, Tl, Th, U, V, and Zn). Method 6020 lists fifteen elements approved for analysis by ICP/MS (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Ni, Ag, Tl, and Zn). Methods 6020A and 6020B lists twenty-three elements approved for analysis by ICP/MS (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V and Zn). This procedure has been developed for thirty-five elements (see Table VII), and additional elements may be included if the method performance criteria presented in Sections 9 and 10 are met. However, project approval may be required from the controlling agencies for compliance testing beyond the elements included in the promulgated methods. See Table XII for a list of elements and associated reporting limits; please note that as of this SOP revision these are the current reporting limits. Reporting limits are subject to change, please refer to TALs for the updated reporting limits.
- **1.3** The procedure is applicable to the analysis of acid digested waters, soils, and wastes. The preliminary acid digestion for aqueous samples is described in SOP TA-IP-0205, and the digestion procedure for soils is given in SOP TA-IP-0220.
- **1.4** On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Section 12.2.1 in the Quality Assurance Manual.

### 2.0 <u>Summary of Method</u>

- **2.1** Aqueous samples, digestates, or leachates are nebulized into a spray chamber where a stream of argon carries the sample aerosol through the quartz torch and injects it into a R.F. plasma. There the sample is decomposed and desolvated.
- **2.2** The ions produced are entrained in the plasma gas and by means of a water-cooled, differentially pumped interface, introduced into a high-vacuum chamber that houses a quadrapole mass spectrometer capable of providing a resolution better than or equal to 0.9 amu (see Section 3.1) peak width at 10% of the peak height. For analysis by methods 200.8, the resolution requirement is 1.0 amu at 5% peak height. The ions are sorted according to their mass-to-charge ratio and measured with a channel electron multiplier.
- **2.3** Interference must be assessed and valid corrections applied, or the data flagged to indicate problems. Interference correction must include compensation for background ions contributed by the plasma gas, reagents, and the constituents of the sample matrix. Recommended elemental equations, which correct for many of these interferences, are listed in Table I. Use of the internal standard technique is required to compensate for suppressions and enhancements caused by sample matrices.

### 3.0 <u>Definitions</u>

- **3.1** Atomic Mass Unit (amu) Obsolete term replaced by "unified atomic mass unit (u)" or "dalton (Da)", which denotes a small unit of mass that is used to express atomic and molecular masses. It is defined to be 1/12 of the mass of one atom of carbon-12, or 1.66053886 X 10<sup>-27</sup> kg.
- **3.2** Dissolved Metals Those elements which pass through a 0.45-μm membrane filter (sample is acidified after filtration).

- **3.3** Suspended Metals Those elements which are retained by a 0.45-µm membrane filter.
- **3.4** Total Metals The concentration determined on an unfiltered sample following vigorous acid digestion.
- **3.5** Total Recoverable Metals The concentration determined on an unfiltered sample following treatment with hot, dilute mineral acids.
- **3.6** Instrument Detection Limit (IDL) See Section 12.1.1.
- **3.7** Sensitivity The slope of the analytical curve (i.e., the functional relationship between raw instrument signal and the concentration).
- **3.8** Tuning Solution This is a multi-element solution containing analytes, which are representative of the entire mass range capable of being scanned by the instrument. It is used to optimize the sensitivity of the instrument and to verify the mass resolution meets method criteria.
- **3.9** Initial Calibration Verification / Quality Control Standard (ICV/QCS) A multi-element standard of known concentrations prepared to verify instrument calibration. This solution must be an independent standard prepared near the mid-point of the calibration curve, and at a concentration other than that used for instrument calibration.
- **3.10** Continuing Calibration Verification (CCV) A multi-element standard of known concentrations prepared to monitor and verify the instrument daily continuing performance.
- **3.11** Interference Check Standard (ICS) A solution containing both interfering and analyte elements of know concentration that is used to verify background and interelement correction factors.
- **3.12** Laboratory Control Sample / Laboratory Fortified Blank (LCS/LFB) A multi-element standard of known concentrations that is carried through the entire sample preparation and analysis procedure. This solution is used to verify the accuracy of the sample preparation.
- **3.13** Reagent Blank High purity (> 18 megohmcm) DI water containing the same acid matrix as the calibration standards that is carried through the entire digestion process.
- **3.14** Calibration Blank High purity (> 18 megohmcm) DI water acidified with the same acid concentrations present in the standards and samples. Also referred to as the Initial Calibration Blank (ICB) and Continuing Calibration Blank (CCB).
- **3.15** Method Detection Limit (MDL) See section 12.1.2.

### 4.0 Interferences

- 4.1 Isobaric Interferences
  - **4.1.1** Isobaric interferences in the ICPMS are caused by isotopes of different elements forming ions with the same nominal mass-to-charge ratio (m/z). Most interferences of this type are corrected for by the instrument software.
- **4.2** Isobaric Molecular and Doubly Charged Ion Interferences
  - **4.2.1** Isobaric molecular interferences are caused by ions consisting of more than one atom or charge. Table III lists isobaric interferences which might possibly affect required analytes. When these interferences cannot be avoided by the use of another isotope with sufficient natural abundance, corrections must be applied and the data flagged to indicate the presence of interferences.

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- **4.2.2** Chloride in samples can produce low recoveries for antimony and silver. If chloride interference is a concern, 1% HCl can be added during digestion, but calibration standards must be adjusted to include 1% HCl also.
- 4.3 Physical Interferences
  - **4.3.1** Physical interferences are associated with the transport and nebulization process. Internal standards are used to compensate for these types of interferences.
  - **4.3.2** Internal standards should be added at a level to give greater than 100,000 counts of raw signal intensity. The mass of the internal standard should ideally be within 50 amu of the mass of the measured analyte.
  - **4.3.3** Matrix effects are monitored by comparing the internal standard intensity in the sample to the internal standard intensity of the calibration blank. When performing method 6020, the internal standard intensities must be between 30% and 120% of the intensities in the calibration blank. For method 6020A and 6020B, the internal standard intensities must be ≥30% If they fall outside this window, a five-fold dilution (1:4) is performed on the sample to correct for matrix effects and the sample is reanalyzed. For method 200.8, the internal standards must be between 60% and 125% of the calibration blank. If they are outside this window, the sample is diluted by a factor of 2 (1:1) and is reanalyzed.
  - **4.3.4** Memory effects are dependent on the relative concentration differences between samples and/or standards which are analyzed sequentially. The rinse period between samples must be long enough to eliminate significant memory interference.
- **4.4** The use of hydrochloric and sulfuric acids should be minimized due to higher incidence of molecular-ion interferences with the presence of these acids. Excessive amounts of nitric acid can also lead to molecular interferences.

### 5.0 <u>Safety</u>

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

### 5.1 Specific Safety Concerns or Requirements

**5.1.1** The ICP plasma emits strong UV light and is harmful to vision. All analysts must avoid looking directly at the plasma. The RF Generator produces strong radio frequency waves, most of which are unshielded. People with pacemakers should not go near the instrument while in operation.

### **5.2** Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating.

**NOTE:** This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the SDS for each of the materials listed in the table.

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A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the SDS for each material before using it for the first time or when there are major changes to the SDS.

Material <sup>(1)</sup>	Hazards	Exposure Limit <sup>(2)</sup>	Signs and Symptoms of Exposure
Nitric Acid	Corrosive Oxidizer Poison	2 ppm TWA 4 ppm STEL	Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract. Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Hydrochloric Acid	Corrosive Poison	5 ppm Ceiling	Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death. Can cause redness, pain, and severe skin burns. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
<ul><li>(1) Always add acid to water to prevent violent reactions.</li><li>(2) Exposure limit refers to the OSHA regulatory exposure limit.</li></ul>			

## Materials with Serious or Significant Hazard Rating

## 6.0 Equipment and Supplies

## 6.1 <u>Instrumentation</u>

- Inductively Coupled Plasma Mass Spectrometer (ICP/MS) capable of providing resolution, less than or equal to 0.9 amu at 10% peak height from 6-253 amu and 1.0 amu at 5% peak height from 6-253 amu with a data system that allows corrections for isobaric interferences and the application of the internal standard technique
- Autosampler with autosampler tubes
- A four-channel peristaltic pump
- Vacuum pump, Recirculating Chiller, Spray Chamber Cooling Power Pack

## 6.2 <u>Computer hardware and software</u>

- Computer with a minimum 1GB memory, Pentium 4 processor, 80 G hard drive or equivalent or as recommended by instrument manufacturer.
- Data acquisition/processing system: Agilent 7500 ICP-MS ChemStation or equivalent
- LIMS system: TALS version 1.0 or higher

### 6.3 <u>Supplies</u>

- Calibrated automatic pipettes or Class A glass volumetric pipettes
- Argon gas: High purity grade (99.99%)

### 7.0 <u>Reagents and Standards</u>

**7.1** Document reagent/standards and reagent/standard preparation in TALS using the reagent module as described in SOP TA-QA-0619.

#### 7.2 Standards

- 7.2.1 Storage and Shelf-Life
  - **7.2.1.1** All standards must be stored in FEP fluorocarbon or previously unused polyethylene or polypropylene bottles. Standards stored at concentrations as received from the vendor and mid-level dilutions must be replaced prior to the expiration date assigned by the vendor. If no expiration date is provided, the stocks and mid-level standards may be stored for up to one year. They must be replaced sooner if verification from an independent source indicates a problem.
  - **7.2.1.2** Working standards, i.e., all standards at concentrations ready to analyze on the ICP/MS (all except tuning mixes, ICSA and ICSAB mixes, which are received at ready-to-use concentrations), are prepared every three months.
- **7.2.2** The tuning solution is purchased as a custom multi-element mix or as single element solutions. The elements and concentrations of the constituents are shown in Table VIII.
- **7.2.3** Initial calibration standards are purchased as custom multi-element mixes or as single element solutions. The standards are prepared every three months and diluted to working levels using a combination of 2% nitric acid and 1.5% hydrochloric acid. The concentrations are given in Table XI.
- **7.2.4** Initial calibration verification (ICV) standards are obtained from a source different than the source for the calibration standards. The ICV standards are prepared every three months in a solution of 2% nitric acid and 1.5% hydrochloric acid to the concentrations shown in Table XI.
- **7.2.5** Continuing calibration verification (CCV) standards are prepared from the same source as the calibration standards. The CCV standards are prepared every three months in a solution of 2% nitric acid and 1.5% hydrochloric acid. The concentration is different than the ICV, as shown in Table XI.
- **7.2.6** Reporting limit (RL), LLICV, and CCVL verification standards are prepared every three months from the same stock as the calibration standards using a solution of 2% nitric acid and 1.5% hydrochloric acid. The concentrations must be less than or equal to the reporting limits.
- **7.2.7** Linear dynamic range (LDR) studies are conducted every six months. Hg at 50 μg/L; Na, Mg, Al, P, K, Ca, Fe at 250,000 μg/L; Ti, Mo, Ag, Sn, Sb, Tl at 1,000 μg/L; the remaining elements at 10,000 μg/L

**<u>7.2.7.1</u>** 6020B and DOD require a LDR verification within 10% of the true value with each calibration. If an LDR verification is not analyzed

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for any specific element, the highest standard in the calibration becomes the LDR.

**7.2.8** Spiking solutions are CLP Sample Spike solution. Spike concentrations are listed in Table XI.

### 7.3 Reagents

7.3.1 DI Water

ASTM Type I or equivalent for the elements of interest generated using an ionexchange water polishing system capable of achieving 18.0 megohm-cm.

**7.3.2** Acid Diluent, 2% HNO<sub>3</sub> and 1.5% HCl

Carefully dilute 220 mL of concentrated  $HNO_3$  and 165 mL of concentrated HCl to 11 L with Dl water. This solution is used to dilute samples, and it is used for calibration blanks.

**7.4** Managers/supervisors or a designee are expected to check their areas on a monthly basis for expired standards/reagents and dispose of them according to SOP TA-EHS-0036.

### 8.0 <u>Sample Collection, Preservation, Shipment and Storage</u>

- 8.1 Aqueous samples and digestates are stored at room temperature.
- **8.2** Aqueous samples are preserved with nitric acid to a pH of 2, and may be stored in plastic or glass. Preservation must be verified prior to analysis.
- **8.3** Soil samples do not require preservation, but must be stored at 0-6°C until the time of preparation.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time <sup>1</sup>	Reference
Waters	HDPE	50 mL	HNO <sub>3</sub> , pH < 2;	180 Days	40 CFR Part 136.3
Soils with Hg Analysis	Glass	1 gram	<u>≤</u> 6C	180 Days	SW-846, Chapter 3 Table 3.1
Soils	Glass	1 gram	None	180 days	SW-846, Chapter 3 Table 3.1

8.4 The analytical holding times for metals are six months from the time of collection.

<sup>1</sup> Inclusive of digestion and analysis.

## 9.0 Quality Control

- **9.1** Quality control requirements are also summarized in TABLE X.
- **9.2** Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method. Control limits are maintained in the laboratory LIMS system. See QC SOP TA-QA-0620 for definition of QC terms, details about establishing control limits, minimum elements of a preparation batch, and general guidelines for evaluating batch QC.
- **9.3** QC result that fails to meet control criteria must be documented in a Nonconformance Memo (NCM). Failing QC that is automatically flagged by TALS does not need a NCM as long as it is a routine failure. The NCM is approved by the supervisor and then

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automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate and the NCM can be included in the report narrative. The QA department also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP TA-QA-0610.

**9.4** Method Blank / Laboratory Reagent Blank (MB/LRB)

For aqueous and soil samples, the method blank consists of DI water that has been processed in the same manner as the samples. For soil samples analyzed under the DoD QSM, the method blank consists of polyethylene beads that have been processed in the same manner as the samples. One method blank must be processed with each preparation batch. In addition, the method blank should be analyzed at the same dilution as the associated samples.

Acceptance Criteria: Method blank results are acceptable if the concentration for each analyte of interest is less than the applicable reporting limit (RL).

- **NOTE:** Some programs (e.g., DoD) require control of method blanks to have a concentration less than or equal to one-half of the RL. Some programs (LaMP) and method 6020A require no detections in the method blank more than 10% of the low limit calibration check solution. Method 200.8 requires no detection in the method blank greater than 2.2X the MDL. This can not be obtained in some cases. TestAmeria Seattle will only evaluate the method blank to 1/2 the RL or Project DQOs and when specific DQOs are not provided by the client the RL will be defined as the DQO.
- Corrective Action: If the method blank does not meet the acceptance criteria, the source of contamination should be investigated to determine if the problem can be minimized or eliminated. Samples associated with the contaminated blank shall be reprocessed for analysis or, under the following circumstances, may be reported as qualified (qualifier flags or narrative comments):
  - The same analyte was not detected in the associated samples;
  - The method blank concentration is less than 1/10 of the measured concentration of any sample in the batch;
  - The method blank concentration is less than 1/10 the specified regulatory limit; or
  - The analyte is a common laboratory contaminant (copper, iron, lead, calcium, magnesium, potassium, sodium, or zinc) less than 2 times the RL. Note that some programs do not recognize common lab contaminants.

If the above criteria are not met and reanalysis is not possible, then the sample data must be qualified. This anomaly must be addressed in the project narrative and the client must be notified.

**9.5** Laboratory Control Sample / Laboratory Fortified Blank (LCS/LFB)

The LCS consists of DI water that is spiked with the analytes of interest as summarized in Table XI. For soil samples analyzed under the DoD QSM, the LCS consists of polyethylene beads that have been spiked with the analytes of interest and processed in the same manner as the samples. One LCS must be processed for each preparation

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batch. However, if there is not sufficient sample volume for a matrix spike duplicate or sample duplicate, then precision information for the batch will need to be derived by processing a LCSD.

- Acceptance Criteria: LCS control limits are based on three standard deviations of past laboratory results. These limits are not to exceed 85-115% recovery for Method 200.8 or 80-120% for Method 6020, 6020A and 6020B. The control limits are maintained in the LIMS system.
- Corrective Action: If the LCS % recovery falls outside of the control limits for any analyte, that analyte is judged to be out of control. All associated samples must be reprocessed for analysis. One possible exception is a recovery for a given element above the upper control limit with no detection for the same element in the samples. (No such allowance is permitted for BP LaMP samples).
- **9.6** Matrix Spike / Matrix Spike Duplicate / Laboratory Fortified Sample Matrix / Laboratory Fortified Matrix Duplicate (MS/MSD/LFM/LFMD)

An MS is prepared by taking a second aliquot of a selected sample and spiking it with the analytes of interest as summarized in Table XI. An MSD is prepared by taking a third aliquot of a selected sample and spiking it with the analytes of interest as summarized in Table XI. The MS and MSD are processed in the same manner as the samples. One MS/MSD pair must be processed for each preparation batch. If there is not sufficient sample volume for a matrix spike duplicate or sample duplicate, then precision information for the batch will need to be derived by processing a LCSD. The spike concentration should be the same level as the LCS. (For BP LaMP samples, a trip blank or field blank should not be used for MS/MSD).

- Acceptance Criteria: Control limits are based on three standard deviations of past laboratory results. These limits are not to exceed 80-120% recovery (70-130% for 200.8), and 20% relative percent difference (RPD). The control limits are maintained in the LIMS system.
- Corrective Action: If MS/MSD results do not meet the acceptance criteria and all other quality control criteria have been met, then matrix interference is suspected. Failed matrix spikes are flagged automatically, and are discussed in the final report case narrative.

### 9.7 Interference Check Solutions (ICSA/ICSAB) method 6020/A/B only

**NOTE**: It may not be possible to obtain pure ICSA or ICSB standards. 6020B has no ICSAB requirements.

The interference check solution is prepared with known concentrations of interfering elements so a determination may be made as to the magnitude of the interference on analytes of interest as well as a test of any software corrections. The required elements and their concentrations are listed in Table VI. The interference check solutions must be analyzed at the beginning of every analytical run or once every 12 hours (for BP LaMP samples - prior to analytical run, every 8 hours and after analysis), whichever is more frequent. The results of solution "A" and solution "AB" should be monitored for possible interferences. See Table VI for analyte concentrations.

Acceptance Criteria: The results for the interference solution (A portion) must be  $\leq$  LOD (unless they are a verified trace impurity form one of the spike analytes).

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- Corrective Action: If ICSA results exceed the LOD and the suspected trace impurities aren't verified, then the analysis sequence must be terminated. The problem must be investigated and fixed. The ICS and all affected samples must be re-analyzed. If the contamination can be confirmed by another method (e.g., ICPAES), acceptance criteria will be applied at that level and the data accepted.
- Acceptance Criteria: The results for the trace elements (AB portion) must be within  $\pm$  20% of the expected value.
- Corrective Action: If the ICSAB results exceed the 20% limit, then the analysis sequence must be terminated. The problem must be investigated and fixed. The ICS and all affected samples must be re-analyzed.
- **9.8** Internal Standards Evaluation for Samples
  - 9.8.1 Method 6020

The IS recovery in samples must be between 30% and 120% of the intensity of the calibration blank. For 6020A/B, IS recovery must be greater or equal to 30%. If sample IS recoveries fall outside of this criterion, a five-fold (1:4) dilution must be performed, the dilution analyzed, and the same acceptance criteria applied.

#### **9.8.2** Method 200.8

The internal standards in samples must be between 60% and 125% of the intensity in the calibration blank. If the sample intensities fall outside this range, the sample is diluted by a factor of 2 (1:1) and reanalyzed.

**9.8.3** IS limits and corrective actions for standards and blanks are described in Section 10.

### 9.9 Serial Dilution method 6020/A/B only

One serial five-fold dilution should be analyzed per batch. If the analyte concentration is within the linear range of the instrument and sufficiently high (generally, a factor of 25 times above the RL or for BNSF and BP LaMP a factor of 5 times above the RL), the serial dilution must agree to within 10% (20% 6020B) of the original analysis. If not, an interference effect is suspected, which must be described in an anomaly report and included in the final report narrative. Samples identified as blanks cannot be used for serial dilution.

### 9.10 Post-Digestion Spike Addition (PDS) method 6020/A/B only

A PDS is performed for each batch. An analytical spike added to a portion of a prepared sample, or its dilution, should be recovered to within 75 - 125% of the known value. If the PDS fails to meet this criterion, matrix interference should be suspected. For 6020A, PDS recoveries are 80 - 120%.

- **9.11** For analytical sequences that include BNSF and/or BP LAMP samples, the RSD between multiple instrument integrations must be <20% if the analyte is greater than the reporting limit. If the RSD is above 20% then the laboratory must reanalyze the sample.
- **9.12** Any extra QC that is analyzed in a batch or sequence must be evaluated using the same criteria as the corresponding QC above. Corrective action for a failing PDS is a Serial Dilution Test. This test is run as standard practice in all analytical batches.

### 10.0 <u>Procedure</u>

One-time procedural variations are allowed only if deemed necessary in the professional judgment of supervision to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using an NCM. The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA department also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP TA-QA-0610. The NCM shall be filed in the project file and addressed in the case narrative.

Any unauthorized deviations from this procedure must also be documented as a nonconformance, with a cause and corrective action described.

#### 10.1 <u>Sample Preparation</u>

Solid and aqueous samples must be digested prior to analysis by the appropriate method (see SOPs TA-IP-0204 and TA-IP-0205).

#### 10.2 Instrument Start Up

Set up the instrument according to manufacturer's operating instructions. Allow the instrument to become thermally stable for at least 30 minutes before tuning. The current operating conditions of each instrument must be either written, or printed out and attached to the corresponding instrument maintenance logbook.

#### 10.3 Instrument Tuning / Mass Calibration

- **10.3.1** Tune the instrument with a solution containing elements representing all of the mass regions of interest. The relative standard deviations must be less than 5% after running the tuning solution a minimum of 4 times. For method 200.8, the tuning solution must be analyzed 5 times with a relative standard deviation less than 5%.
- **10.3.2** Mass calibration and resolution checks using the tuning solution must be completed at the beginning of every day.
  - **10.3.2.1** Mass Calibration Check The mass calibration results must be within 0.1 amu from the true value. If this criterion is not met, the mass calibration must be adjusted before running samples.
  - **10.3.2.2** Mass Resolution Check The resolution must be verified to be less than 0.9 amu full width at 10% peak height. Due to a limitation of the instrument software, the resolution requirement for method 200.8 of 1.0 amu full width at 5% peak height cannot be verified automatically. If the mass resolution requirement of 0.9 amu at 10% peak height is met, the 200.8 requirement is also satisfied.

### 10.4 Initial Calibration

**10.4.1** The calibration curve is established on each day of operation using a blank and five standards. The preparation of the ICAL standards is described in Section 7. The final concentrations of the ICAL standards are presented in Table XI. Report the average of at least three integrations. An r value of 0.995 or better is required for analysis to continue for any element. If an element does not meet the requirement, it must be recalibrated. If an element does not meet this requirement it may not be reported during that days run. For details regarding calibration models and algorithms, refer to corporate SOP CA-Q-S-005.

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- **10.4.2** The validity of the calibration is determined by the subsequent calibration verifications, which are performed at concentrations as described in the next sections.
- **10.4.3** The internal standard recoveries for 6020 must fall between 30% and 120% of true values, 6020A/B must be ≥30%, and for 200.8 must fall between 60% and 125% of true values.

### 10.5 <u>Second-Source Initial Calibration Verification (ICV)</u>

An ICV standard (see Section 7.2.4) is analyzed immediately after the initial calibration. This is a standard obtained from a different vendor than the standard used for calibration. This analysis also satisfies the Method 200.8 requirement for a Quality Check Standard (QCS).

Acceptance Criteria: The ICV recovery must be within 90-110%. The ICV can be reanalyzed, but must be successful twice in succession or corrective action must be taken.

Corrective Action: If the ICV results are outside of the acceptance limits, investigate the accuracy of the standards, correct as necessary, and recalibrate.

### 10.6 <u>Calibration Blank</u>

An initial calibration blank (ICB) is analyzed after the ICV. Continuing calibration blanks (CCBs) are analyzed after each continuing calibration verification.

Acceptance Criteria: Results for the calibration blanks must be less than the RL.

- **Note:** All projects that are under the DoD QSM and BP LAMP will evaluate the calibration blanks to ensure the criteria of no analytes being detected above ½ LOQ/RL. Any analyte above the ½ LOQ/RL will be qualified B on all associated DoD samples.
- Corrective Action: If the calibration blank exceeds acceptance limits, then the possibility of instrument contamination should be examined, particularly the possibility of carry-over from high level samples. The blank can be reanalyzed, and if successful, analysis can continue. However, samples tested after high-level samples should be retested. If the reanalysis is not successful, then the analysis should be terminated. After the problem is corrected, recalibrate and reanalyze all samples tested since the last acceptable CCB.

### 10.7 Reporting Limit (RL) Verification Standard, LLICV, CCVL

An independent standard is analyzed after the ICV to monitor the lab's ability to produce reliable results at RL level concentrations. The RL verification standard (see Section 7.2.6) is analyzed after the daily ICB. (For BP LaMP the RL verification standard is run prior to analysis, every 8 hours and after analysis. The standard must be within 2 times the RL concentration.)

Acceptance Criteria: For project reporting limits at or above two times the MDL, the results should be within 50% of the expected value. Note that the DoD QSM requires control of the low-level calibration check standard to  $\pm$  20% of the expected value, in which case the RLs will need to be three or more times the MDL concentration. For

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DoD QSM 5.0, the acceptance limit is  $\pm$  20% for LLICV. For 6020B, the acceptance limit is  $\pm$  35% for LLICV and RSD should be < 20%. For 6020A, the acceptance limit is  $\pm$  30% for LLICV/CCVL. For BP LAMP, the acceptance limit is  $\pm$  30% for LLICV and CCVL.

Corrective Action: If the RL verification fails to meet acceptance limits, data for the associated samples must be assessed. For example, if the results are high, consider blank contamination, and if the results are low, consider MDL verifications. At a minimum, sample results must be qualified in the final report.

### 10.8 Continuing Calibration Verification (CCV) Standard

A 50  $\mu$ g/L CCV standard is analyzed after every set of ten samples and at the end of the analytical sequence.

- Acceptance Criteria: The CCV recovery must be within 90-110%. If CCV results are not within these limits, the CCV can be reanalyzed, but it must be successful twice in succession or further corrective action must be taken.
- Corrective Action: If the CCV fails acceptance criteria, then the analysis should be terminated. Recalibrate and reanalyze all samples tested since the last acceptable CCB.

Calibration Controls	Sequence	Control Limit
Calibration Standards	5-point (minimum) linearity	r≥ 0.995 (LaMP 0.998)
Cont. Cal. Verif. (CCV)	Prior to / after every 10 injections	Recovery 90-110 %
Cont. Cal. Blank (CCB)	Following ICV/CCB	<2X MDL

#### 10.9 Sample Analysis

- **10.9.1** Report the average of at least three integrations for all field and QC samples analyzed.
  - **10.9.1.1** For analytical sequences that include BNSF and/or BP LAMP samples the RSD between multiple instrument integrations must be <20% if the analyte is greater than the reporting limit. If the RSD is above 20% then the laboratory must reanalyze the sample.
- **10.9.2** Flush the system with the rinse blank for at least 30 seconds between samples and standards during the analytical run.
- **10.9.3** Masses, which would affect the data quality, must be monitored during the analytical run to determine the potential effects of matrix on a given element.
- 10.9.4 Dilute and reanalyze samples that are more concentrated than the linear range for an analyte or specific isotope of interest. No analyte may be reported from an analysis of a diluted sample in which the analyte concentration is less than 5 times the IDL. (The sample should be diluted to the approximate midrange of the analytical curve.)

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**10.9.5** The analytical run sequence should be performed as follows to meet all quality control criteria:

Instrument initialization Warm-up Tune instrument Perform mass calibration Perform resolution check Validate tuning criteria Calibration blank Calibration standards ICV ICB RL verification standard / LLICV **ICSA ICSAB** LDR Check (6020B/DOD) CCV CCVL (6020A) CCB 10 Samples (which can include all sample types) CCV CCVL (6020A) CCB 10 samples CCV CCVL (6020A) CCB

### 10.10 Data Reduction and Review

- **10.10.1** Upon completion of the analytical sequence, review the raw data to determine if dilutions are necessary and then perform a level 1 data review and document the review on the data review checklist.
- **10.10.2** Submit the data package and review checklist to the peer reviewer for the level 2 review. The data review process is explained in SOP TA-QA-0635. All data is calculated using the formulas in Section 11.
- **10.10.3** Update instrument sequence logbook.

### 10.11 Instrument Maintenance

- **10.11.1** All instrument maintenance must be documented in the instrument maintenance logbook.
  - Routine Maintenance (which includes, but is not limited to daily, weekly, and semiannual maintenance) is completed periodically and does not necessary indicate the instrument is out of control. It is noted in the logbook with the notation "RM". RM maintenance might include weekly cleaning of cones and changing tubing.
  - The logbook must include the instrument name, serial number for each major component (e.g., AA, autosampler) and the date of start-up.

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- When an instrument is not capable of analyzing samples, it needs to be tagged "Out of Service".
- For non-routine maintenance or repairs, logbook entries must include a description of the problem and what actions were taken to address the problem.
- When non-routine maintenance or repairs are complete, the instruments return to control is noted in the logbook with the notation "RTC".
- **10.11.2** Daily Use and Maintenance
  - For both the P.E. and Agilent instruments, the daily tune and daily mass calibration will be printed, monitored for changes and included in the instrument sequence logbook.
- **10.11.3** Weekly Maintenance (or more frequently if needed)
  - Change the pump tubing as needed.
  - Check pump and pump rollers.
- **10.11.4** Monthly Maintenance (or more frequently if needed)
  - Clean the nebulizer as needed when instrument reading are inconsistent.
  - Clean the torch as needed. Sonicate the nebulizer in mild soap for 10 minutes to clean.
  - Clean the spray chamber if dirty.
  - Check the air filters on the power supply and spectrometer, and clean if dirty.
- **10.11.5** Annual and Semiannual Maintenance (or more frequently if needed)
  - Clean the chiller.
  - Change the oil in the rough pump
  - Change the Lens as needed
  - Change the cell annually or as needed

### **10.11.6** Spare Parts

### 10.11.6.1 Instrument supplies

- Purge windows.
- Injector tip.
- Lens
- Cell

## 10.11.6.2 Plasma Torch Assembly.

- Quartz torch.
- Spray chamber.
- Nebulizer.

### 10.11.6.3 Tubing

- Sample tubing.
- Drain tubing.
- Internal standard tubing
- Sample capillary tubing and sample probe

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### 10.12 <u>Troubleshooting</u>

**10.12.1** Refer to Appendix A, Troubleshooting Guide.

### 11.0 Calculations / Data Reduction

For details regarding calibration models and algorithms, refer to corporate SOP CA-Q-S-005.

### 11.1 Accuracy

<u>ICV / CCV, LCS % Recovery</u> = <u>observed concentration</u> x 100 known concentration

<u>MS % Recovery</u> = (spiked sample) - (unspiked sample) x 100 spiked concentration

## 11.2 Precision (RPD)

<u>Matrix Duplicate (MD)</u> = <u>|orig. sample value - dup. sample value|</u> x 100 [(orig. sample value + dup. sample value)/2]

## 11.3 Concentration

The final concentration for an aqueous sample is calculated as follows:

Result 
$$(\mu g/L) = \frac{C \times V1 \times D}{V2}$$

Where: C = Concentration from instrument readout, ppb
D = Instrument dilution factor
V1 = Final volume in liters after sample preparation
V2 = Initial volume of sample digested in liters
Note: Samples prepared for total recoverable analytes by Method 200.8 will have a

preparation dilution factor of 1.25.

The concentration determined in digested solid samples when reported on a wet weight basis is as follows:

$$\operatorname{Result}(\mu g/\mathrm{kg}) = \frac{C \times V \times D}{W}$$

Where: C = Concentration from instrument readout, ppb D = Instrument dilution factor V = Final volume in liters after sample preparation

W = Weight, in g, of wet sample digested

NOTE: All dry weight corrections are made in LIMS at the time the final report is prepared.

### 12.0 <u>Method Performance</u>

#### 12.1 Instrument and Method Detection Limit Studies

- **12.1.1** Instrument Detection Limit (IDL) IDLs are determined by analyzing seven replicates of low concentration undigested standards on each of three nonconsecutive days, calculating the standard deviation for each day's results, and calculating the average of the three standard deviations. The IDL must be performed annually.
- **12.1.2** The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure (see SOP CA-Q-S-006). MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method or program requirements require a greater frequency.
- **12.1.3** Linear Dynamic Range (LDR)

Linear range standards (see Section 7.2.7 for preparation) must be analyzed semiannually.

Acceptance Criteria:	The highest standard must produce a recovery within 90-
	110% of the expected value. Then the highest LDR is 90% of the highest successful standard.

- Correction Action: Samples producing results above the LDR must be diluted reanalyzed.
- **<u>12.1.3.1</u>** Linear Range Verification

The LDR should be verified whenever, in the judgment of the analyst, a change in the analytical performance caused by either a change in instrument hardware or operating conditions would dictate the necessity to re-establish them.

Acceptance Criteria:	The LDR verification standard must produce a result within 90-110% of the expected value.
Corrective Action:	If this limit is not met, then a new LDR study is required.
Some programs (e.g., each analytical run or the high standard.	USACE/Navy) require verification of linear ranges in the samples must be diluted at the concentration of
Acceptance Criteria:	Results must be within 90-110% of the expected value.
Corrective Action:	Samples producing results greater than the concentration of the daily check standard will be diluted and reanalyzed.

## 12.2 <u>Demonstration of Capabilities</u>

Analyst initial and continuing Demonstrations of Capability (DOC) are performed before any client samples are analyzed and are updated annually. See SOP TC-QSM-0617 for details.

### 12.3 <u>Training Requirements</u>

See SOP TC-QSM-0608 for detailed training requirements.

## 13.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention".

### 14.0 <u>Waste Management</u>

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to Waste Disposal SOP TA-EHS-0036.

14.1 Waste Streams Produced by the Method

Metals acid waste – Acid waste consisting of sample and rinse solution: Waste in which the only hazardous constituent is its pH is neutralized and sewered. Standards and any other high metal waste are collected in satellite waste stations. The waste is then taken to the waste warehouse where it is bulked and sent out for chemical precipitation with or without treatment.

### 15.0 <u>References / Cross-References</u>

- **15.1** Test Methods For Evaluating Solid Waste, EPA SW-846, 3rd Edition, Final Update II, Method 6020: "Inductively Coupled Argon Plasma Mass Spectrometry", Revision 0, September 1994.
- **15.2** Test Methods For Evaluating Solid Waste, EPA SW-846, Update IV, Method 6020A: "Inductively Coupled Argon Plasma - Mass Spectrometry", Revision 1, February 2007.
- **15.3** Test Methods For Evaluating Solid Waste, EPA SW-846, 4th Edition, Draft Update V, Method 6020B: "Inductively Coupled Argon Plasma Mass Spectrometry", Revision 2, July 2014.
- **15.4** Environmental Monitoring Systems Laboratory, EPA Method 200.8, "Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma Mass Spectrometry", Revision 5.4, EMMC Version.

### 16.0 <u>Method Modifications:</u>

ltem	Method	Modification
1	6020/A/B, 200.8	Commercially available standards are purchased and verified at the laboratory rather than being prepared from the solid material. These verification records are kept on file.
2	6020/A/B, 6020A, 200.8	The results of the calibration blank as well as all other blanks must be less than the reporting limit, not 3 times the instrument IDL.
3	6020/A/B, 6020A	The serial dilution results are evaluated when the original result is greater than 100 times the MDL rather than 100 times the concentration in the reagent blank.
----	--------------------	---
4	6020/A/B, 6020A	Corrective action for a PDS failure will be limited to generating an NCM indicating the failed analyte and the recovery rather than diluting and reanalyzing the sample.
5	6020/A/B, 6020A	Internal standard recoveries are based on the intensities of the internal standards in the most recent calibration blank rather than the intensities of the internal standards in the initial calibration standard.
6	6020/A/B, 6020A	The internal standard recovery limits for the ICV/CCV and ICB/CCB results is 30 - 120% for all analyses as stated in method 6020A rather than 80-120% as stated in method 6020.
7	200.8	Resolution criteria of the mass calibration are met if the resolution criteria for method 6020 are satisfied.
8	6020A 6020B	Method Blank criteria of no detections in the method blank more than 10% of the low limit calibration check solution. TestAmeria Seattle will only evaluate the method blank to 1/2 the RL or Project DQOs and when specific DQOs are not provided by the client the RL will be defined as the DQO.
9	200.8	Method Blank criteria of no detections in the method blank more than 2.2 times method detection limit. TestAmeria Seattle will only evaluate the method blank to 1/2 the RL for DoD and LaMP projects and to the RL for all other projects.
10	6020A 6020B	IDL Studies are being performed annually not every 3 months.

# 17.0 <u>Tables</u>

Table I: Recommended Elemental Equations

Table II: Contributions of Contaminant Elements when Resolution and Measurement Schemes Vary

Table III: Isobaric Molecular-Ion Interferences Which Could Affect the Analytes

Table IV: Changes in Isobaric Molecular-Ion Interferences with Changing Plasma Conditions

Table V: Recommended Internal Standards

Table VI: Interference Check Sample Components and Concentrations

Table VII: Suggested Mass Choices

Table VIII: Tuning Solution

Table IX: Suggested Tuning and Response Factor Criteria

Table X: Summary of Quality Control Requirements

Table XI: Calibration, Calibration Verification, and Spike Concentrations

Table XII: Reporting Limits

Appendix A: Troubleshooting guide

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## 18.0 <u>Revision History</u>

- Revision 28.1, dated 19 October 2020
  - Updated approvers
  - Updated ICB and CCB acceptance criteria, section 10.6
  - Updated table XII, reporting limits
- Revision 28, dated 9 August 2019
  - Re-branding
  - Added 6020A and 6020B to sections 1.2 and 9.5
  - Added MS/MSD requirements for 200.8, section 9.6
  - Updated MDL SOP reference, section 12.1.2
  - Added reference for 6020B to section 15.0
  - Updated table XII, reporting limits
- Revision 27.1, dated 13 June 2018
  - No changes
- Revision 27, dated 2 May 2017
  - Incorporated Method 6020B throughout.
  - Updated Internal Standard limits, sections 4.3.3, 10.4.3 and Table X
  - o Added more detail for the Linear Dynamic Range study, section 7.2.7
  - Removed dilutions for method 200.8, section 10.9.4
  - Added LDR Check sample, section 10.9.5
  - Updated Table VI and XII
- Revision 26, dated 2 March 2016
  - Incorporated ROMD 00063 in sections 12.1.1 and 16.0
- Revision 25, dated 24 September 2014
  - Changed all references of Reagent water to DI water
  - Added r value criteria to ICAL section 10.4.1
  - Updated method blank criteria, section 9.4
  - Updated section 16.0 to add modification to 200.8
- Revision 24, dated 4 January 2014
  - o Updated section 4.3.3 with 6020A internal standard intensity criteria
  - Added computer hardware and software, section 6.2
  - Updated section 7.2.6 to include LLICV and CCVL
  - Updated NCM criteria, section 9.3
  - Updated method blank criteria, section 9.4
  - o Updated section 9.8 with 6020A internal standard intensity criteria
  - Updated serial dilution criteria for LaMP, section 9.9
  - Updated PDS criteria fro 6020A and added corrective action, section 9.10
  - Updated section 10.4.3 with 6020A internal standard intensity criteria
  - Updated section 10.7 to include LLICV and CCVL
  - Updated section 10.9.5 to include LLICV and CCVL
  - Added troubleshooting, section 10.12
  - Updated section 16.0 to add modification to 6020A
  - Added Appendix A, section 17.0

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- Revision 23, dated 6 August 2012
  - Update safety intro, section 5.0
  - Added instructions for diluting the method blank by the same factor as associated samples, section 9.4
  - Updated pollution control, section 13.0
  - Updated waste streams, section 14.1
- Revision 22, dated 25 April 2011
  - Under 4.3.2 the IS should be added at a level greater than 100,000 not 1,000,000
  - Preservation temps aligned with SW-846 chapter 3 were added in section 8.4
  - Incorporated ROMD 00025 in sections 9.5 and 9.6
  - Incorporated ROMD 00020 in section 10.2
  - Incorporated ROMD 00022 in sections 10.4.1 and 11.0
  - Added section 10.4.3 about IS limits
  - The reference under 10.7 section 7.1.6 was changed to 7.2.6
  - Made corrections to the table under 10.8
  - Section 10.10 was added about data review
  - Under 10.11.1, an explanation of what RM consists of
  - Added more complete instrument maintenance information in section 10.11
  - Incorporated ROMD 00033 in section 10.11.2
  - Table V was revised
  - Table VI was changed to reflect the dilution of this standard
  - Strontium was added to table VII
  - Suggested Mass Calibration information was updated in Table IX
  - Updated soil RLs in Table X11
- Revision 21, dated 16 April 2010
  - Added documentation of standards/reagents and standard/reagent preparation Section 7.1
  - Updated concentrations for nitric/hydrochloric acid mixture Section 7
  - Added removal of expired standards Section 7.4.
  - Updated Method Blank criteria for BP LaMP, Section 9.4
  - Updated LCS criteria for BP LaMP, Section 9.5
  - Updated 9.7 ICS-A/AB criteria for BP LaMP, Section 9.7
  - Added criteria for additional QC, Section 9.11.
  - o Updated Calibration Blank control criteria 10.6
  - Updated MRL Standard criteria for BP LaMP, Section 10.7
  - Added maintenance documentation and return to service requirements, Section 10.10.1
  - Updated TableVI with interference check sample components and concentrations
- Revision 20, dated 13 August 2009
  - Added Table XII.X. Summary of Quality Control Requirements
- Revision 19, dated 28 February 2009
  - Updated RLs in Table XII.
- Revision 18, dated 22 February 2008
  - Integration for TestAmerica and STL operations.

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Element	Isobaric Correction	Mathematical Equation
Al	none	(1.0000)(27M)
Sb	none	(1.0000)(121M)
As	ArCl, Se	(1.0000)(75M) - (3.1278)(77M) + (1.0177)(78M)
Ba	none	(1.0000)(135M)
Be	none	(1.0000)(9M)
Cd	MoO, Sn	(1.0000)(114M) - (0.0268)(118M) - (1.0000)(135M)
Ca	none	(1.0000)(44M)
Cr	none	(1.0000)(52M)
Co	none	(1.0000)(59M)
Cu	none	(1.0000)(65M)
Fe	none	(1.0000)(57M)
Pb	none	(1.0000)(208M) + (1.0000)(207M) + (1.0000)(206M)
Mg	none	(1.0000)(25M)
Mn	none	(1.0000)(55M)
Hg	none	(1.0000)(200M)
Ni	none	(1.0000)(60M)
K	none	(1.0000)(39M)
Se	Ar2	(1.0000)(78M) - (1.1869)(76M)
Ag	none	(1.0000)(107M)
Na	none	(1.0000)(23M)
TI	none	(1.0000)(205M)
V	CIO, Cr	(1.0000)(51M) - (3.1081)(53M) + (0.3524)(52M)
Zn	none	(1.0000)(66M)
6Li	Li (natural)	(1.0000)(6M) - (0.0813)(7M)
Sc	none	(1.0000)(45M)
Y	none	(1.0000)(89M)
Rh	none	(1.0000)(103M)
In	Sn	(1.0000)(115M) - (0.0149)(118M)
Tb	none	(1.0000)(159M)
Но	none	(1.0000)(165M)
Bi	none	(1.0000)(209M)

# **TABLE I: Recommended Elemental Equations**

Where M = Total ion count rate at the specified mass.

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# TABLE II: Contributions of Contaminant Elements when Resolution and Measurement Schemes Vary

Concentrations listed are the approximate level ( $\mu$ g/L) measured when the interferent is present at 100 mg/L.

		Peak Width at 10% of the Peak Height			
	Interferent	1.0 amu Integ	gration Width	0.8 amu Integ	gration Width
Analyte	Element	0.9 amu	0.3 amu	0.9 amu	0.3 amu
<sup>121</sup> Sb	<sup>120</sup> Sn	820	5	10	1
<sup>121</sup> Sb	<sup>122</sup> Te	77	None	1	none
<sup>75</sup> As	<sup>74</sup> Se, <sup>76</sup> Se	910	4	3	none
<sup>9</sup> Be	<sup>10</sup> B	1,200	12	9	1
<sup>112</sup> Cd	<sup>113</sup> ln	1,700	8	10	none
<sup>114</sup> Cd	<sup>115</sup> ln	5,000	150	180	18
<sup>116</sup> Cd	<sup>115</sup> ln	30	None	5	none
<sup>52</sup> Cr	<sup>51</sup> V	1.4	1.5	none	none
<sup>53</sup> Cr	<sup>54</sup> Fe	650	7	1	none
<sup>59</sup> Co	<sup>58</sup> Ni, <sup>60</sup> Ni	1,500	6	2	none
<sup>63</sup> Cu	<sup>62</sup> Ni, <sup>64</sup> Ni	190	1	none	none
<sup>63</sup> Cu	<sup>64</sup> Zn	4,000	14	9	none
<sup>65</sup> Cu	<sup>64</sup> Ni	1	1	none	none
<sup>65</sup> Cu	<sup>64</sup> Zn, <sup>66</sup> Zn	4,400	22	15	none
<sup>208</sup> Pb	<sup>209</sup> Bi	140	14	57	none
<sup>55</sup> Mn	<sup>54</sup> Fe, <sup>56</sup> Fe	900	8	4	none
<sup>58</sup> Ni	<sup>59</sup> Co	3,000	96	75	7
<sup>60</sup> Ni	<sup>59</sup> Co	9	4	10	5
<sup>62</sup> Ni	<sup>63</sup> Cu	8,500	690	4,500	16
<sup>107</sup> Ag	<sup>106</sup> Pd, <sup>108</sup> Pd	2,400	22	80	4
<sup>107</sup> Ag	<sup>106</sup> Cd, <sup>108</sup> Cd	130	3	5	2
<sup>109</sup> Ag	<sup>108</sup> Pd, <sup>110</sup> Pd	1,800	12	36	3
<sup>109</sup> Ag	<sup>108</sup> Cd, <sup>110</sup> Cd	1,600	10	37	3
<sup>51</sup> V	<sup>52</sup> Cr	2,100	45	410	1
<sup>64</sup> Zn	<sup>65</sup> Cu, <sup>63</sup> Cu	7,800	57	410	2
<sup>66</sup> Zn	<sup>65</sup> Cu	2	none	3	2

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	Interferences							
Analyte	Oxygen	Hydroxyl	Nitrogen	Chlorine	Sulfur	Carbon	Other	
<sup>121</sup> Sb	PdO		AgN			AgC		
<sup>123</sup> Sb	AgO		AgN	SrCl	ZrS	CdC		
<sup>75</sup> As	CoO	NiOH	NiN	ArCl	CaS	CuC		
<sup>138</sup> Ba	SnO	SbOH						
<sup>137</sup> Ba	SbO	SnOH		MoCl				
<sup>136</sup> Ba	SnO	SnOH				SnC		
<sup>135</sup> Ba	SnO	SnOH		MoCl				
<sup>134</sup> Ba	SnO	SnOH	SnN	MoCl		SnC		
<sup>132</sup> Ba	SnO, CdO	InOH	SnN	MoCl	MoS	SnC		
<sup>130</sup> Ba	CdO	CdOH	SnN, CdN	MoCl	MoS	SnC		
<sup>9</sup> Be								
<sup>114</sup> Cd	MoO	MoOH	MoN	SeCl	SeS			
<sup>112</sup> Cd	MoO, ZrO	MoOH	MoN	AsCl, SeCl	SeS	MoC		
<sup>111</sup> Cd	MoO	MoOH	MoN	GeCl				
<sup>110</sup> Cd	MoO, ZrO		MoN, ZrN	GeCl, AsCl	SeS	MoC		
<sup>113</sup> Cd	MoO	MoOH		SeCl, AsCl				
<sup>116</sup> Cd	MoO							
<sup>106</sup> Cd	ZrO		MoN, ZrN		GeS	MoC, ZrC		
<sup>108</sup> Cd	MoO, ZrO	ZrOH	MoN, ZrN	GeCl	SeS, GeS	MoC, ZrC		
<sup>52</sup> Cr	ArO	CIOH				ArC		
<sup>53</sup> Cr	CIO	ArOH	KN	NCI, OCI		KC		
<sup>50</sup> Cr	SO		ArN		SO	ArC	Mo <sup>++</sup>	
<sup>54</sup> Cr		CIOH	ArN, CaN			CaC		
<sup>59</sup> Cr	CaO	CaOH	ScN	MgCl	AIS	TiC	Sn⁺⁺	
<sup>63</sup> Cu	TiO, PO <sub>2</sub>	TiOH	TiN	SiCl, MgCl	PS	VC	ArNa	
<sup>65</sup> Cu	TiO	TiOH	VN	SiCl	SS, SO <sub>2</sub> H	CrC		
<sup>208</sup> Pb								
<sup>206</sup> Pb								
<sup>207</sup> Pb								
<sup>204</sup> Pb								
<sup>55</sup> Mn	KO	ArOH	KN		NaS	CaC	Cd++	

# TABLE III: Isobaric Molecular-Ion Interferences Which Could Affect the Analytes

	Interferences						
Analyte	Oxygen	Hydroxyl	Nitrogen	Chlorine	Sulfur	Carbon	Other
<sup>202</sup> Hg	WO						
<sup>200</sup> Hg	WO	WOH	WN				
<sup>199</sup> Hg	WO	WOH					
<sup>201</sup> Hg		WOH					
<sup>198</sup> Hg	WO	TaOH	WN			WC	
<sup>204</sup> Hg							
<sup>196</sup> Hg			WN				
<sup>58</sup> Ni	CaO	KOH	CaN	NaCl	MgS	TiC	Cd++, Sn++
<sup>60</sup> Ni	CaO	CaOH	TiN	MgCl, NaCl	SiS	TiC	Sn++
<sup>62</sup> Ni	TiO	ScOH	TiN	AICI, MgCI	SiS	TiC, CrC	Sn⁺⁺
<sup>61</sup> Ni	SeO	CaOH	TiN	MgCl	SiS	TiC	
<sup>64</sup> Ni	TiO	TiOH	TiN, CrN	SiCI, AICI	SS	CrC	
<sup>80</sup> Se	ZnO	CuOH	ZnN	ScCl, CaCl	TiS	ZnC	
<sup>78</sup> Se	NiO	NiOH	ZnN	CaCl, KCl	TiS	ZnC	
<sup>82</sup> Se	ZnO	CuOH	ZnN	TiCl, ScCl	TiS, CrS		
<sup>76</sup> Se	NiO	CoOH	NiN	KCI	CaS	ZnC	
<sup>77</sup> Se	NiO	CuN	CuN	CaCl, ArCl	ScS	CuC	
<sup>74</sup> Se	NiO	NiN	NiN	CICI, KCI	CaS	NiC	
<sup>107</sup> Ag	ZrO	ZrOH		GeCl	AsS	MoC	
<sup>109</sup> Ag		MoOH	MoN	GeCl	SeS	MoC	
<sup>205</sup> TI							
<sup>203</sup> TI		WOH					
<sup>51</sup> V	CIO	SOH	CIN	CIO, CIN	FS	KC	
<sup>50</sup> V	SO		ArN			ArC	Мо
<sup>64</sup> Zn	TiO	TiOH	TiN, CrN	SiCI, AICI	SS	CrC	
<sup>66</sup> Zn	TiO	TiOH	CrN	PCI, SiCI	SS	FeC	
<sup>68</sup> Zn	CrO	VOH	FeN	PCI	ArS	FeC	Ba++
<sup>67</sup> Zn	VO	TiOH, Cr	CrN	SCI	CIS	MnC	Ba++
<sup>70</sup> Zn	FeO	CrOH	GeN	CICI	ArS	NiC	

# TABLE III: (cont.) Isobaric Molecular-Ion Interferences Which Could Affect the Analytes

**NOTE**: The information provided in this table does not indicate that all of the described interferences need to be tested. However, the table can be consulted for informational purposes if unusual samples are encountered.

		Ν	Nebulizer Flow Rate		
	Molecular Interference	High	Average	Low	
Oxides	ScO/Sc	0.00326	0.00055	0.00116	
	YO/Y	0.00568	0.00395	0.00353	
	TbO/Tb	0.0156	0.00648	0.00614	
	CIO, CI	0.00725	0.00227	0.00233	
Hydroxides	ScOH/Sc	0.00040	0.00011	0.00000	
	YOH/Y	0.00078	0.00044	0.00048	
	TbOH/Tb	0.00034	0.00008	0.00011	
	CIOH/CI	0.00048	0.00031	0.00029	
Chlorine	CIO/CI	0.00725	0.00227	0.00233	
	CIOH/CI	0.00048	0.00031	0.00029	
	ArCI/CI	0.00605	0.00091	0.00477	

# Table IV:Changes in Isobaric Molecular-Ion Interferences with<br/>Changing Plasma Conditions\*\*

\*\* Information for this table is being determined by the EPA.

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Method 6020	Method 200.8
Li 6	Li 6
Rh	Rh
Sc	Sc
Ge	Ge
Но	Но
Lu	Lu
Bi	Bi

# **Table V: Recommended Internal Standards**

Table VI: Interference Check Sample Components and Concentrations (ICSAB minors are suggested spike levels)

Interference Component	Solution A Concentration (mg/L)	Solution AB Concentration (mg/L)
Al	25	25
Ca	30	30.0
Fe	25	25.0
Mg	10	10.0
Na	25	25.0
Р	10	10.0
K	10	10.0
S	10	10.0
С	20	20.0
CI	100	100.0
Мо	0.2	0.2
Ti	0.2	0.2
As	0.0	0.02
Cd	0.0	0.02
Cr	0.0	0.04
Со	0.0	0.04
Cu	0.0	0.04
Mn	0.0	0.04
Ni	0.0	0.04
Se	0.0	0.02
Ag	0.0	0.01
V	0.0	0.04
Zn	0.0	0.02

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# Table VII: Suggested Mass Choices

Boldface masses indicate the masses which must have the most impact on data quality and the elemental equations used to collect the data. Suggested masses for method 200.8 are in "quotes."

Mass	Element of Interest
"27"	Aluminum
121, " <b>123</b> "	Antimony
"75"	Arsenic
138, "137", 136, <b>135</b> , 134, 132, 130	Barium
"9"	Beryllium
<b>114</b> , 112, "111", 110, 113, 116, 106	Cadmium
42, 43, <b>44</b> , 46, 48	Calcium
" <b>52</b> ", <b>53</b> , <b>50</b> , 54	Chromium
"59"	Cobalt
"63", 65	Copper
<b>56</b> , <b>54</b> , <b>57</b> , 58	Iron
" <b>208</b> ", " <b>207</b> ", " <b>206</b> ", 204	Lead
24, <b>25</b> , <b>26</b>	Magnesium
"55"	Manganese
196, 198, 199, <b>200</b> , <b>201</b> , " <b>202</b> ", 204	Mercury
58, " <b>60</b> ", 62, <b>61</b> , 64	Nickel
39	Potassium
80, <b>78</b> , " <b>82</b> ", <b>76</b> , <b>77</b> , 74	Selenium
"107", 109	Silver
23	Sodium
88	Strontium
" <b>205</b> ", 203	Thallium
" <b>51</b> ", <b>50</b>	Vanadium
64, " <b>66</b> ", <b>68</b> , <b>67</b> , 70	Zinc
72	Germanium
139	Lanthanum
118	Tin
35, 37	Chlorine
"98", 9 <mark>6, 92, <b>97</b>, 94</mark>	Molybdenum

**NOTE**: It is strongly recommended that elements other than those of interest be monitored to indicate other potential molecular interferences that could affect the data quality.

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# Table VIII: Tuning Solution

A tuning solution containing elements representing all of the mass regions of interest must be analyzed. Below are two groups of suggested solutions that cover a typical mass calibration range.

Element	Concentration (µg/L)	
Solution A		
Mg	10	
Rh	10	
Pb	10	
Solution B		
Li	10	
Со	10	
In	10	
TI	10	

# Method 6020

# Method 200.8

Element	Concentration (µg/L)
Be	10
Mg	10
Со	10
In	10
Pb	10

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# Table IX: Suggested Tuning and Response Factor Criteria

# Minimum Response from Tuning Solution:

Be	>1,000
Mg	>2,000
RŇ	>20,000
Pb	>10,000
Li	>2,000
Со	>20,000
In	>1,000
ΤI	>1,000

# **Suggested Mass Calibration:**

Be	9
Mg	24
Rĥ	103
Pb	208
Li	7
Co	59
In	115
ΤI	203

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QC Parameter	Frequency*	Acceptance Criteria	<b>Corrective Action</b>
IS	Every reading.	6020 IS, 30-120% rec. 200.8 IS, 60-125% rec. 6020A/B IS ≥ 30% rec.	Terminate analysis; correct the problem; recalibrate.
ICV/QCS	Beginning of every analytical run.	90 - 110% recovery. 6020B, < 20% RSD	Terminate analysis; correct the problem; recalibrate.
ICB/CB	Immediately after each ICV	The result is < RL. For DoD QSM, < LOD.	Terminate analysis; correct the problem; recalibrate.
RL/LLICV	Beginning of every analytical run.	6020 & 200.8: 50 - 150% rec. 6020A: 70-130% rec. 6020B: 65-135% rec. DoD: 80-120% rec.	Terminate analysis; correct the problem; recalibrate.
CCV	Beginning and end of run and every 10 samples <u>OR</u> every 2 hours, whichever is more frequent. Beginning and end of each lot.	90 - 110% recovery.	Reanalyze once. If acceptable, continue. If unacceptable, terminate analysis; correct the problem recalibrate the instrument, reverify calibration and rerun all samples since the last acceptable CCV.
CCVL			
ССВ	Immediately following each CCV.	The result must be < RL. For DoD QSM, < LOD.	Reanalyze once. If acceptable, continue. If unacceptable, terminate analysis; correct the problem, recalibrate the instrument, verify calibration and rerun all samples since the last acceptable CCB.
ICSA	Beginning and every 12 hours.	Monitor for possible interferences. For DoD QSM, < LOD (unless they are a verified trace impurity form one of the spike analytes).	See Section 9.7

# Table X: Summary of Quality Control Requirements

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QC Parameter	Frequency*	Acceptance Criteria	<b>Corrective Action</b>
ICSAB	Immediately following each ICSA.	Monitor for possible interferences. For DoD QSM, ± 20%.	See Section 9.7
Method Blank/Laboratory Reagent Blank	One per lot of 20 field samples or fewer.	The result must be < RL. Sample results greater than 10x the blank concentration or samples for which the contaminant is < RL, do not require redigestion or reanalysis. <b>For DoD QSM, &lt; 1</b> / <sub>2</sub> <b>RL.</b>	Redigest and reanalyze samples. Note exceptions under criteria section. See Section 9.4 for additional requirements.
Laboratory Control Sample (LCS)	One per sample preparation batch of up to 20 samples.	LCS must be within 80 - 120% recovery or QSM 5.0 control limits. (85-115% for 200.8) Samples for which the contaminant is < RL and the LCS results are > 120% (115% for 200.8) may not require redigestion or reanalysis (see Section 9.5).	Terminate analysis; Correct the problem; Redigest and reanalyze all samples associated with the LCS.
Matrix Spike (MS)	One per sample preparation batch of up to 20 samples.	75 – 125% recovery or tighter in-house control limits. <b>For DoD:</b> Use LCS control limits.	In the absence of client specific requirements, flag the data; no flag required if the sample level is > 4x the spike added.
Matrix Spike Duplicate (MSD)	One per sample preparation batch of up to 20 samples. 10% frequency for some programs (see Error! Reference source not found.)	75 - 125 % recovery; RPD $\leq 20\%$ or tighter in-house control limits. For DoD: Use LCS control limits.	See Corrective Action for Matrix Spike.
Serial Dilution (6020 Only)	One per batch of 20 field samples or fewer.	90 - 110% recovery	See Section 9.9 for additional requirements.

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QC Parameter	Frequency*	Acceptance Criteria	Corrective Action
Post-Digestion Spike (6020 Only)	One per batch of 20 field samples or fewer.	75-125% recovery 80-120% for 6020A	See Section 9.10.
Matrix Spike/Laboratory Fortified Matrix	One per lot of 20 field samples or fewer.	Must be within laboratory control limits	See Section 9.6 for additional requirements.

Element	Initial Calibration Levels (μg/L)				ICV (μg/	CCV (µg/L)	LCS (µg/L)	MS/MSD (μg/L)	
	1	2	3	4	5	L)			
Aluminum	1	10	100	500	1000	400	500	80	80
Antimony	0.1	1	10	50	100	40	50	60	60
Arsenic	0.1	1	10	50	100	40	50	80	80
Barium	0.1	1	10	50	100	40	50	80	80
Beryllium	0.1	1	10	50	100	40	50	2	2
Cadmium	0.1	1	10	50	100	40	50	2	2
Calcium	10	100	1000	5000	10,000	4000	5000	400	400
Chromium	0.1	1	10	50	100	40	50	8	8
Cobalt	0.1	1	10	50	100	40	50	20	20
Copper	0.1	1	10	50	100	40	50	10	10
Iron	10	100	1000	5000	10,000	4000	5000	440	440
Lead	0.1	1	10	50	100	40	50	20	20
Magnesium	10	100	1000	5000	10,000	4000	5000	400	400
Manganese	0.1	1	10	50	100	40	50	20	20
Mercury	0.005	0.05	0.5	2.5	5	2	2.5	1.0	1.0
Molybdenum	0.1	1	10	50	100	40	50	100	100
Nickel	0.1	1	10	50	100	40	50	20	20
Potassium	1	10	100	500	1000	4000	5000	400	400
Selenium	0.1	1	10	50	100	40	50	80	80
Silver	0.1	1	10	50	100	40	50	12	12
Strontium	0.1	1	10	50	100	40	50	40	40
Thallium	0.1	1	10	50	100	40	50	80	80
Tin	0.1	1	10	50	100	40	50	100	100
Titanium	0.1	1	10	50	100	40	50	100	100
Uranium	0.1	1	10	50	100	40	50	40	40
Zinc	0.1	1	10	50	100	40	50	20	20

# Table XI: Calibration, Calibration Verification, and Spike Concentrations

This procedure has been developed for thirty-five elements (See Table VIII). Additional elements may be included in the calibration solution at the above levels. Levels may be adjusted to meet specific regulatory or client programs.

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# Table XII: Reporting Limits

Element	Water Low Level (µg/L)	Water (µg/L)	Soil Low Level (µg/kg)	Soil (µg/kg)
Aluminum	100	500	15,000	30,000
Antimony	0.8	4	300	500
Arsenic	1	5	250	500
Barium	1.2	6	500	1000
Beryllium	0.4	2	100	200
Cadmium	0.8	4	400	800
Calcium	10,000	50,000	50,000	100,000
Chromium	0.8	4	500	1000
Cobalt	0.4	2	100	200
Copper	2	10	500	1000
Iron	200	1000	20,000	40,000
Lead	0.8	4	250	500
Magnesium	10,000	50,000	50,000	100,000
Manganese	2	10	550	1500
Mercury	0.25	1.25	100	200
Molybdenum	0.8	4	200	400
Nickel	3	15	250	500
Potassium	10,000	50,000	50,000	100,000
Selenium	8	40	550	1500
Silver	0.4	2	100	200
Sodium	10,000	50,000	75,000	150,000
Strontium	0.4	2	250	500
Thallium	1	5	200	400
Tin	10	50	1500	3000
Titanium	1	5	500	1000
Uranium	0.6	3	100	200
Vanadium	4	20	1000	2000
Zinc	7	35	2550	5500

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### Appendix A – Troubleshooting Guide

#### Error Messages

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#### Error Messages

The following messages can appear in the ChemStation green message bar when you operate the Agilent 7500. When an error message is displayed, the instrument runs a safety sequence.

Click on an error No., and you will jump to the error message corresponding to the error No.

#### NOTE:

An \* (asterisk) indicates that an error number has multiple messages and contents. Please check the error message and error number to properly identify the problem.

1000	1001	1002	1003	1004	1005	1006 *
1007	1008	1009 *	1010 *	1011	1012 *	1013
1014	1015	1016 *	1017	1018	1019	1020
1021	1022	1023	1024	1025	1026	1027
1090	1099	1100	<u>1101 *</u>	1102 *	1103 *	1104 *
1109 *	1110 *	<u>1111 *</u>	1112*	<u>1113 *</u>	1114	1115*
<u>1116 *</u>	<u>1117</u>	<u>1118 *</u>	<u>1119 *</u>	<u>1120 *</u>	<u>1121 *</u>	1122
1123	1124	<u>1125</u>	<u>1126</u>	1127	1128	<u>1129</u>
<u>1130</u>	<u>1131</u>	<u>1132</u>	<u>1133 *</u>	<u>1134</u>	<u>1135</u>	<u>1136</u>
<u>1137</u>	<u>1138</u>	<u>1139 *</u>	<u>1140</u>	<u>1141</u>	<u>1142</u>	<u>1143 *</u>
<u>1144</u>	<u>1145</u>	<u>1146</u>	<u>1147</u>	<u>1148</u>	<u>1149 *</u>	<u>1150</u>
<u>1151 *</u>	<u>1152</u>	<u>1153</u>	<u>1200</u>	<u>1201</u>	1202	1203
1204	1205	<u>1206</u>	1208 *	1209	<u>1210</u>	1211 *
<u>1212</u>	<u>1213</u>	<u>1214</u>	<u>1215 *</u>	<u>1216</u>	<u>1217</u>	<u>1218</u>
<u>1219 *</u>	1220	<u>1221 *</u>	1222	<u>1223</u>	1226	<u>1300</u>
<u>1301</u>	1302	<u>1303</u>	<u>1304</u>	<u>1305</u>	<u>1306</u>	<u>1307</u>
1308	<u>1309</u>	<u>1400 *</u>	1402	<u>1410</u>	<u>1411</u>	<u>1413</u>
<u>1414</u>	<u>1415</u>	<u>1416</u>	<u>1417</u>	<u>1418</u>	1422	<u>1430</u>
1432	1433	<u>1434</u>	<u>1435</u>	<u>1436</u>	<u>1440 *</u>	<u>1441</u>
1442	<u>1443</u>	<u>1445</u>	<u>1446</u>	<u>1449</u>	<u>1450</u>	<u>1451</u>
1452	1453	<u>1454</u>	<u>1455</u>	<u>1518</u>	<u>1519</u>	1520
1521	1522	1523	1524	1525	1526	

#### Alarm Messages Number List

NOTE:

An \* (asterisk) indicates that an error number has multiple messages and contents. Please check the error message and error number to properly identify the problem.

2150 *	2151 *	2152	2153	2400 *	2402
2403	2404	2405	2412	2413	2414
2415	<u>2416</u>	2433	2435	2605	2606
2607	2608	2609	2610	3000	3001
3002	3003	3004			

1000 Execution Error: Instrument is busy- Between Transition Modes. Attempted to execute a command that cannot be executed during mode transition. Transitioning modes.

mk:@MSITStore:C:\ICPCHEM\ICPEXE\ICP-MS.CHM::/IDH\_ErrMsg.htm

2/3/2014

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Problem	Possible Cause/ Solution
High Blanks	Increase rinse time Clean or replace tip Clean or replace torch Clean or replace sample tubing Clean or replace nebulizer Clean or replace mixing chamber
Instrument Drift	RF not cooling properly Replace torch (Crack) Clean or replace nebulizer (blockage) Check room temperature (changing) Replace pump tubing Room humidity too high Clean torch tip (salt buildup) Check for argon leaks Adjust sample carrier gas Replace PA tube
Erratic Readings, Flickering Torch or High RSD	Check for argon leaks Adjust sample carrier gas Replace tubing (clogged) Check drainage(back pressure changing) Increase uptake time (too short) Increase flush time (too short) Clean nebulizer, torch or spray chamber Increase sample volume introduced Check that autosampler tubes are full Sample or dilution of sample not mixed Increase integration time (too short) Realign torch Reduce amount of tubing connectors



Environment Testing TestAmerica

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Seattle

# Title: Determination of Volatile Organic Compounds by GC/MS [Methods 8260D]

Approvals				
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#### 1.0 Scope and Application

- **1.1** This method is applicable to the determination of volatile organic compounds (VOCs) in water, wastewater, soils, sludges, and other solid matrices. Standard analytes are listed in Tables 1, 2, and 3.
- **1.2** This SOP is applicable to Method 8260D.
- **1.3** This method can be used to quantify most volatile organic compounds that have boiling points below 200 °C and are insoluble or slightly soluble in water. Volatile water-soluble compounds can be included in this analytical technique; however, for more soluble compounds, quantitation limits are approximately ten times higher because of poor purging efficiency.
- **1.4** The method is based upon a purge-and-trap, gas chromatograph/mass spectrometric (GC/MS) procedure. The approximate working range is 1 to 100  $\mu$ g/L for 8260D waters, <u>0.02 ug/L to 100ug/L for 8260D low-level waters</u>, <u>1</u> to 100  $\mu$ g/kg for low-level soils, and 20 to 6,000  $\mu$ g/kg for medium-level soils.
- 1.5 Reporting limits can be located in TALS > Global Method Data > Methods (select method) > Limits View > LT Code (select "RL") > Select Matrix.
- **1.6** Method performance is monitored through the use of surrogate compounds, matrix spike/matrix spike duplicates (MS/MSD), and laboratory control samples (LCS/LCSD).
- **1.7** On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Section 12.2.1 in the Quality Assurance Manual.

#### 2.0 Summary of Method

- **2.1** Volatile compounds are introduced into the gas chromatograph by the purge and trap method. The components are separated via the gas chromatograph and detected using a mass spectrometer, which is used to provide both qualitative and quantitative information.
- **2.2** Aqueous samples are purged directly. Generally, soils are preserved by extracting the volatile analytes into methanol. If especially low detection limits are required, soil samples may be sampled directly into pre-tarred VOA vials which contain 5mL reagent free water, a magnetic stir bar, and are immediately frozen; or collected in a suitable container to be transferred in total or by aliquot to a VOA vial and purged directly.
- **2.3** In the purge-and-trap process, an inert gas (generally Helium) is bubbled through the solution at ambient temperature and the volatile components are efficiently transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent column where the volatile components are trapped. After purging is completed, the sorbent column (trap) is heated and back flushed with inert gas to desorb the components onto a gas chromatographic column. The gas chromatographic column is then heated to elute the components, which are detected with a mass spectrometer.
- **2.4** Qualitative identifications are confirmed by analyzing standards under the same conditions used for samples and comparing the resultant mass spectra and GC retention times. Each identified component is quantified by relating the MS response for an appropriate selected ion produced by that compound to the MS response for another ion produced by an internal standard.

#### 3.0 <u>Definitions</u>

3.1 Batch

The batch is a set of up to 20 samples of the same matrix processed using the same procedures and reagents within the same time period. Using this method, each 4-bromofluorobenzene (BFB) analysis will start a new batch. for calibrations and a continuing calibration verification standard (CCV) will start a new batch for analytical samples. Batches for methanol soils are defined at the sample preparation stage and may be analyzed on multiple instruments over multiple days, although reasonable effort should be made to keep the samples together.

The Quality Control batch must contain a matrix spike/spike duplicate pair (MS/MSD), a Laboratory Control Sample (LCS), and a method blank. If there is insufficient sample to perform the MS/MSD, a duplicate LCS

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is used to establish batch precision when requested by the client. Refer to SOP TA-QA-0620 for further details of the batch definition.

3.2 Method Blank (MB)

A method blank consisting of all reagents added to the samples must be analyzed with each batch of samples. The method blank is used to identify any background interference or contamination of the analytical system, which may lead to the reporting of elevated concentration levels or false positive data. Sparged water or water that has been boiled then cooled to ambient temperature is used as the blank medium for water batches and muffled Ottawa Sand for soil batches. Prepared (muffled at 400C for at least 4 hours) batches of Ottawa sand are tracked using the reagent data base in the Laboratory Information Management System (known as TALS) and are at the time of the writing of this SOP named with the following convention: VoaSand\_XXXXX.

#### **3.3** Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

A blank matrix (reagent water or muffled Ottawa Sand) is spiked with the analytes of interest and is carried through the entire analytical procedure. Analysis of this sample with acceptable recoveries of the spiked materials demonstrates that the laboratory techniques for this method are acceptable. A laboratory control sample duplicate is a second aliquot prepared at the same time as the first. The duplicate demonstrates precision in the preparation.

3.4 Surrogates

Surrogates are organic compounds that are similar to the target analyte(s) in chemical composition and behavior in the analytical process, but that are not normally found in environmental samples. Each sample, blank, LCS, and MS/MSD is spiked with surrogate standards. Surrogate spike recoveries must be evaluated by determining whether the concentration (measured as percent recovery) falls within the required recovery limits.

3.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

A matrix spike is an environmental sample to which known concentrations of target analytes have been added. A matrix spike duplicate is a second aliquot of the same sample, which is prepared and analyzed along with the sample and matrix spike. Matrix spikes and duplicates are used to evaluate accuracy and precision in the actual sample matrix.

**3.6** Initial Calibration Verification (ICV)

The ICV is a second-source calibration verification standard, i.e., different than the source of calibration standards.

**3.8** Continuing Calibration Verification (CCV)

A solution of method analytes, surrogate compounds, and internal standards used to evaluate the performance of the instrument system with respect to a defined set of method criteria.

#### 4.0 <u>Interferences</u>

- **4.1** Method interferences may be caused by contaminants in solvents, reagents, glassware, and other processing apparatus that lead to discrete artifacts. All of these materials must be routinely demonstrated to be free from interferences under conditions of the analysis by running laboratory method blanks as described in the Quality Control section. The use of ultra high purity gases, boiled and cooled to ambient or sparged purified reagent water, and approved lots of purge-and-trap-grade methanol will greatly reduce introduction of contaminants. In extreme cases, the purging vessels may be pre-purged to isolate the instrument from laboratory air contaminated by solvents used in other parts of the laboratory.
- **4.2** Samples can be contaminated by diffusion of volatile organics (particularly Methylene chloride and fluorocarbons) into the sample through the septum seal during shipment and storage. A field blank prepared from reagent water and carried through the sampling and handling protocol can serve as a check on such contamination.

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- **4.3** Matrix interferences may be caused by non-target contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source depending upon the nature and diversity of the site being sampled.
- **4.4** Cross-contamination can occur whenever high-level and low-level samples are analyzed sequentially or in the same purge position on an autosampler. Whenever an unusually concentrated sample is analyzed, it should be followed by one or more blanks to check for cross-contamination. The purge and trap system may require extensive bake-out and cleaning after a high-level sample.

**Note:** Due to the large number of analytes analyzed for in this method, some with higher boiling points are considered Semi-Volatile analytes. It may be necessary to evaluate for cross-contamination at levels above 10 ug/L for Naphthalene and 1,2,3-Trichlorobenzene; above 20 ug/L for n-Butylbenzene and Hexachlorobutadiene; above 50 ug/L for tert-Butylbenzene, sec-Butylbenzene, 4-Isopropyltoluene, 1,2,4-Trichlorobenzene and Ethylbenzene; above 100 ug/L for Methacrylonitrile, 1,3,5-Trichlorobenzene, 1,2-Dibromo-3-Chloropropane and Toluene, and all other analytes should be evaluated for potential cross-contamination above a detected concentration of 150 ug/L or more. (These concentrations are based on a carry-over study conducted by the laboratory detecting cross-contamination above 1/<sub>2</sub> the RL). It may, therefore, be necessary to run an instrument rinse after laboratory spiked samples, such as high calibration levels, CCVs, LCS and MS to ensure no cross contamination occurs. All client samples are also evaluated using the same criteria.

**4.5** Some samples may foam when purged due to surfactants present in the sample. When this kind of sample is encountered, an antifoaming agent (e.g., J.T. Baker's Antifoam B silicone emulsion) can be used and must also be added to the Method Blank (MB).

#### 5.0 <u>Safety</u>

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

- **5.1** Specific Safety Concerns or Requirements
  - **5.1.1** Cut resistant gloves should be used in addition to Nitrile glove when handling materials with sharp, jagged edges or when opening glassware (VOA vials) or packages containing glassware.
  - **5.1.2** The autosampler, purge and trap, gas chromatograph and mass spectrometer contain zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.
  - **5.1.3** The mass spectrometer is under deep vacuum. The mass spectrometer must be brought to atmospheric pressure prior to working on the source.
  - **5.1.4** There are areas of high voltage in both the gas chromatograph and the mass spectrometer. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.
  - 5.1.5 Cut resistant gloves or a protective cloth must be used when opening and closing voa vials.
  - **5.1.6** The toxicity or carcinogenicity of each reagent used in this method has not been fully established. Each chemical should be regarded as a potential health hazard and exposure should be as low as reasonably achievable. Cautions are included for known extremely hazardous materials.

#### 5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. Note: This list does not include all materials used in the method. The table contains a summary of

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the primary hazards listed in the SDS for each of the materials listed in the table. A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the SDS for each material before using it for the first time or when there are major changes to the SDS.

Material	Hazards	Exposure Limit (1)	Signs and symptoms of exposure
Methanol (MeOH)	Flammable Poison Irritant	200 ppm- TWA	A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes.
1 – Exposur	e limit refers to	the OSHA reg	ulatory exposure limit.

#### 6.0 Equipment and Supplies

#### 6.1 <u>Instrumentation</u>

- Gas Chromatograph: The gas chromatograph (GC) system must be capable of temperature programming.
- Gas Chromatographic Column used for 8260:
  - : 60 m X 0.25 mm ID DB-VRX with 1.4 µm film thickness.
  - : 30 m X 0.25 mm ID Rxi-624Sil MS with 1.4 µm film thickness

Note: Other columns may be used. The serial number of the column used is documented in the instrument maintenance logbook.

- Mass Spectrometer: The mass spectrometer must be capable of scanning 35-270 amu at a rate fast enough to acquire at least 4, but preferably 10, mass spectra across each peak, using 70 volts electron energy in the electron impact mode and capable of producing a mass spectrum that meets the required criteria.
- GC/MS interface: In general glass jet separators are used but any interface (including direct introduction to the mass spectrometer) that achieves all acceptance criteria may be used.
- Purge and Trap Device: The purge and trap device consists of the sample purger, the trap, and the desorber.
- Sample Purger: The recommended purging chamber is designed to accept between 5 mL and 25 mL samples with a water column at least 3 cm deep. The purge gas must pass through the water column as finely divided bubbles, each with a diameter of less than 3 mm at the origin. The purge gas must be introduced no more than 5 mm from the base of the water column. Alternative sample purge devices may be used provided equivalent performance is demonstrated. Low level soils are purged directly from a VOA vial.
- Trap: A variety of traps may be used, depending on the target analytes required. The O.I. #10 (Tenax/Silica gel/Carbon Molecular Sieve) is recommended. Other traps may be used if the Quality Control criteria are met.
- Desorber: The desorber should be capable of rapidly heating the trap up to 270 °C depending on the trap packing material.
- Purge-and-trap Autosampler: An autosampler capable of sampling from a sealed vial, OI 4100, or equivalent.

#### 6.2 <u>Computer hardware and software</u>

• Computer with a minimum 1GB memory, Pentium 4 processor, 80 G hard drive or equivalent or as recommended by instrument manufacturer.

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- LIMS system: TALS version 1.0 or higher.
- Data acquisition system: Agilent ChemStation (version E.02.02) or equivalent. Agilent's ChemStation, is used for data acquisition and storage on machine-readable media. Since no processing is done by ChemStation and since there are no audit trail functions associated with data acquisition, the audit trail feature for ChemStation may be either enabled or disabled. The other component, Chrom, is used for data processing such as the measurement of peak area or peak height. By design, the audit trail feature for Chrom is always enabled.
- Data processing: Chrom version 1.2 or higher. The computer must have software that allows searching any GC/MS data file for ions of a specified mass and plotting such ion abundances versus time or scan number. This type of plot is defined as an Extracted Ion Current Profile (EICP). Software must also be available that allows integrating the abundances in any EICP between the specified time or scan-number limits. In addition, for the non-target compounds, software must be available that allows for the comparison of sample spectra against reference library spectra. The most recent release of the NIST/EPA mass spectral library should be used as the reference library. The computer system must also be capable of backing up data for long-term off-line storage.

#### 6.3 Supplies

- Microsyringes: 0.5 μL gas tight and larger, 0.006-inch ID needle
- Balance: Top-loading balance capable of weighing 0.1 g. The balance used for sample preparation is calibrated daily by a designated primary analyst (a back-up analyst is also assigned should the primary be unavailable). The analyst must perform this check according to SOP TA-QA-0014. It is also the responsibility of any analyst performing work on the balance to check the Balance logbook to determine if the daily calibration check has been completed, before beginning work.
- Scintillation Vials: 20 mL with screw caps.
- Volumetric flasks: 10 mL to 200 mL, class A with ground-glass or Teflon ® stoppers.
- Spatula: Stainless steel.
- Disposable pipettes: Pasteur.
- pH paper: (0-7).
- Helium: Ultra high purity, gr. 5, 99.999%.
- Nitrogen: Ultra high purity, from cylinders or gas generators, may be used as an alternative to helium for purge gas.

### 7.0 Reagents and Standards

**7.1** Document reagent/standards and reagent/standard preparation in TALS using the reagent module as described in SOP TA-QA-0619.

### 7.2 <u>Reagents</u>

- 7.2.1 Methanol: Purge and Trap Grade, High Purity
- **7.2.2** Reagent Water: High purity water that meets the requirements for a method blank when analyzed. (See Section 9.3.) Reagent water may be purchased as commercial distilled water or filtered in the laboratory using Barnstead B pure and E Pure filtration systems and prepared by purging with an inert gas for a minimum of 2 hours or boiling and cooling to ambient temperature prior to use. Other methods of preparing reagent water are acceptable.

### 7.3 <u>Standards</u>

- **7.3.1** If stock or secondary dilution standards are purchased in sealed ampoules they may be used up to the manufacturer's expiration date.
  - **<u>7.3.1.1</u>** Purchased standards are stored at the manufacturer's specifications (i.e. ambient, freezer, refrigerator). Standards prepared from these purchased standards are stored in the freezer.

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- 7.3.2 Calibration Stock Standard Solutions: Components of stock solutions may be purchased as certified solutions from commercial sources or prepared from pure standard materials as appropriate. These standards are prepared in methanol and stored in Teflon-sealed screw-cap bottles with minimal headspace at ≤-10°C. Each month a new standard is prepared. Note: Standards may be prepared on a more frequent basis based on analyst observed signs of degradation.
- **7.3.3** Calibration Working standards: A working solution containing the compounds of interest prepared from the stock solution(s) in methanol. These standards are stored in the freezer. Working standards are monitored by comparison to the initial calibration curve. If any of the calibration check compounds drift in response from the initial calibration by more than 20%, then corrective action is necessary. Generally, an analysis of all individual compounds meeting the method criteria will suffice, however a continual failure of CCC compounds may include steps such as instrument maintenance, preparing a new calibration verification standard or tuning the instrument. If the corrective actions do not correct the problem (two CCVs in a row fail), then a new initial calibration must be performed.
- **7.3.4** Aqueous calibration standards are prepared in reagent water using the calibration working standards. These aqueous standards must be prepared daily.

Likewise, medium level methanolic calibration standards are prepared in reagent water with a matrix matched methanol concentration of one fortieth P&T methanol using the calibration working standards and must be prepared daily.

- **7.3.5** Internal standards (IS) are added to all samples, standards, and blank analyses by the autosampler. Refer to Table 5 for internal standard components.
- **7.3.6** Surrogate Standards are added to all samples, standards, and blank analyses by the autosampler: Refer to Table 6 for surrogate standard components and spiking levels.
- **7.3.7** Laboratory Control Sample Spiking Solutions: Refer to Tables 7 and 7a for LCS components and spiking levels.
- **7.3.8** Matrix Spiking Solutions: The matrix spike contains the same components as the LCS. Refer to Tables 7 and 7a.
- **7.3.9** Tuning Standard: A standard is made up that will deliver a maximum 50ng of 4-Bromofluorobenzene on column upon injection.
- **7.4** As soon as standard preparations are completed, the working standards must be refilled to minimize headspace and returned to the freezer.
- **7.5** Managers/supervisors or a designee are expected to check their areas on a monthly basis for expired standards/reagents and dispose of them according to SOP TA-EHS-0036.

#### 8.0 <u>Sample Collection, Preservation, Shipment and Storage</u>

- **8.1** Water samples are normally preserved at pH < 2 with 1:1 hydrochloric acid. The holding time for acidpreserved samples is 14 days from sample collection. For compliance with Method 8260D, unpreserved samples must be tested within 7 days of collection.
- 8.2 Exceptions to the information provided in Section 8.1 above:
  - **8.2.1** 2-Chloroethyl vinyl ether, acrolein, and acrylonitrile are hydrolyzed in the presence of acid. For samples collected for analysis of this compound, a separate vial without acid should be recommended. More detail provided in CA-T-TM-001

ANALYTE	METHOD	PRESERVATION	HOLDING TIME
Acrolein	8260	<6° C (No HCI)	7 days

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	8260	pH <2, <6° C	7 days
Acrylonitrile	8260	<6° C (No HCI)	7 days
	8260	pH <2, <6° C	7 days
2-CEVE	8260	<6° C (No HCI)	7 days

#### 8.3 Soils

- **8.3.1** Approved sampling containers for Method 5035 are EnCores, VOAs (with or without water and stir bar), and VOAs preserved with methanol.
- **8.3.2** The holding time for methanolic preserved samples is 14 days.
- 8.3.3 Soil collected using the EnCore<sup>™</sup> sampler must be preserved in the laboratory within 48 hours of sampling. At specific client request, if the data is to be reported as 5030, the hold time for preservation and analysis is 14 days from collection. The holding time for EnCore<sup>™</sup> samples varies based on client specifications and can be 48 hours, 7 days, or 14 days, see the table in Section 8.4.
- **8.3.4** The holding time for VOAs (with or without water and stir bar) varies based on client specifications and requirements and can be 48 hours, 7 days, or 14 days, see the table in Section 8.4.
- 8.4 Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time <sup>1</sup>	Reference
Waters	Three 40-mL VOA vials	40 mLs	HCl, pH < 2; Cool 0-6°C	14 Days	40 CFR Part 136.3 / 5030
Waters	Three 40-mL VOA vials	40 mLs	Cool 0-6°C	7 Days	40 CFR Part 136.3 / 5030
Soils	Three Encore Samplers	5 grams	Cool 0-6°C or -10 to -20°C	48 Hrs for Preservation or 14 Days	5035A
Soils	40 ml VOA vial or 4oz septa top jar	10 grams or 25 grams	Methanol <6°C	14 Days	5035A
Soils	Three 40-mL VOA vials	5 grams	With or without DI Water -10 to -20°C	14 Days	5035A
Soils	Glass Jar	10 grams	Cool 0-6°C	5035A:48 Hrs for Preservation 14 Days 5030: 14 Days	5035A or 5030C
Waste	Glass Jar	10 grams	Cool 0-6°C	14 Days	5030C

<sup>1</sup> Inclusive of preparation and analysis.

- **8.5** Aqueous samples are stored in three 40 ml glass VOA vials with Teflon lined septa at 0-6°C, with minimal headspace. If a bubble is present and it is less than 6 mm in diameter, analysis may continue with the appropriate NCM added. If headspace exceeds this amount, then a non-conformance memo must be written and in some cases client approval requested to continue analysis.
- 8.6 Soil Sample Collection for Medium-Level Analysis using Field Methanol Preservation
  - **8.6.1** A pre-tared four ounce volatile soil jar with an accompanying VOA vial containing 25ml of a methanol is sent out for each sample when the sampling occurs in the state of Alaska. Otherwise a

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pre-tarred VOA vial containing 10 mls of methanol is sent out for each sample required. In addition the appropriate amount of trip blanks are also sent out. All bottles sent to the field are labeled with the tare weight and lot number of the methanol/surrogate solution or methanol.

- **8.6.2** Field samples are collected in a 1:1 ratio, (grams of sample:mL of MeOH). Alaska samples are placed in the collection container with septa lined lid prior to adding one VOA vial containing 25 mls of methanol/surrogate solution. For all other methods ten gram field samples are collected by adding an appropriate amount of sample to a 40 mL VOA vial already containing 10 mL of methanol.
- 8.7 Soil Sample Collection for Medium-Level Analysis using EnCore<sup>™</sup> or TerraCore<sup>™</sup> samplers.
  - **8.7.1** If the sample is collected a sample in an EnCore<sup>™</sup> sampler a minimum of one EnCores should be provided to the lab. If the samples are collected using the TerraCore sampler a minimum of one 40-ml VOA vial with 5 grams of soil. Samples must be received prior to 48 hours from sampling in order to be frozen or extracted in methanol. Following shipment back to the laboratory, the soil is preserved in methanol.
- 8.8 Soil Sample Collection for Medium-Level Analysis of Unpreserved Soil
  - **8.8.1** When specifically requested by a client, unpreserved soils packed into glass jars or brass tubes may be accepted, subsampled and methanol preserved in the laboratory. These samples have a hold time of 48 hours from sample collection to sub-sampled and preserved if following Method 5035. Otherwise if following Method 5030 the holding time is 14 days to analysis.
- 8.9 Soil Sample Collection for Low-Level Procedure
  - 8.9.1 Samples may be collected in 5g EnCore<sup>™</sup> sampling device (it is recommended that a minimum of two 5g EnCore<sup>™</sup> samples are collected, but three are preferred). Soil samples collected in a 5g EnCore<sup>™</sup> sampling device and returned to the laboratory are extruded into a VOA vial with stir bar and frozen upon receipt or extruded into a scintillation vial with methanol and refrigerated upon receipt.
  - **8.9.2** Samples may be collected in vendor purchased pre-tared VOA vials with or without 10 mL of DI Water with a magnetic stir bar. Samples collected in pre-tared VOA vials are stored at -10 to -20°C in the volatile laboratory soils freezer until sample analysis.
    - **8.9.3** If client specifications require field preservation, samples may be collected in pre-tared VOA vials containing a magnetic stir bar and 5 mL of reagent water. Sample collected in this manner must be received and frozen by the laboratory within 48 hours of sampling. Samples stored in this manner <u>MUST</u> be frozen on their sides to minimize possible breakage of the sample container due to expansion of water as it freezes.
- **8.10** A refrigerator or freezer blank is stored in each refrigerator or freezer with the samples. This is analyzed at minimum every 14 days, but may be analyzed more frequently as needed (see SOP TA-QA-0616). The refrigerator or freezer blank should be run immediately after the method blank.
- 8.11 Percent Moisture Correction for Soils

A percent moisture correction may be performed on soil samples to adjust the extraction final volume of the sample in order to allow for the miscible solvents effect, as required by the client. Percent moisture must be determined if results will be reported as dry weight and percent moisture correction to be performed; refer to SOP TA-WC-0125 for determination of percent moisture. For all methanolic samples with a % moisture of greater than 10%, the following formula is used to determine the corrected final volume:

Corrected FV = ((g of sample \* % Moisture/100) + mL of Methanol) \* 40

(Also noted in section 12.9)

#### 9.0 **Quality Control**

- **9.1** The minimum quality controls (QC), acceptance criteria, and corrective actions are described in this section. When processing samples in the laboratory, use the LIMS QC program code and special instructions to determine specific QC requirements that apply.
  - **9.1.1** The laboratory's standard QC requirements, the process of establishing control limits, and the use of control charts are described more completely in the Eurofins TestAmerica Seattle QAM.
  - **9.1.2** Specific QC requirements for Federal programs, e.g., USACE and Navy projects, are described in DoD QSM v5.3 or the latest promulgated version.
  - **9.1.3** Project-specific requirements can override the requirements presented in this section when there is a written agreement between the laboratory and the client, and the source of those requirements should be described in the project documents. Project-specific requirements are communicated to the analyst via special instructions in the LIMS and may also come in the form of email or written notifications distributed at "project kick off" meetings.
  - **9.1.4** Any QC result that fails to meet control criteria must be documented in a Nonconformance Memo (NCM). The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA group also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP TA-QA-0610. This is in addition to the corrective actions described in the following sections.

#### **9.2** Batch Definition

Batches are defined at the sample preparation stage. The batch is a set of up to 20 samples of the same matrix, plus required QC samples, processed using the same procedures and reagents within the same time period. Batches should be kept together through the whole analytical process as far as possible, but it is not mandatory to analyze prepared extracts on the same instrument or in the same sequence. The method blank must be run on each instrument and in each analytical batch.

9.3 Method Blanks

For each batch of samples, analyze a method blank. The method blank is analyzed after the calibration standards and before any samples. For low-level volatiles in water, the method blank consists of reagent water. For low-level volatiles in soil, the blank medium is muffled Ottawa sand. For medium-level volatiles, the method blank consists of 10 mL of reagent grade methanol and ten grams of muffled Ottawa sand. Surrogates are added and the method blank is carried through the entire analytical procedure.

Acceptance Criteria: For DoD/LaMP projects the method blank must not contain any analyte of interest at or above one-half the reporting limit or above 1/10 the measured concentration of the analyte in the associated samples or 1/10 the regulatory limits, whichever is greater. For DoD projects, when written approval is received (method notes will contain "2CLC" or "Std Var App" to indicate approval has been received), the method blank must not contain any common laboratory contaminants above the reporting limit. Contamination up to the reporting limit is allowed for non DoD/LaMP projects or at or above 1/10 of the measured concentration of that analyte in the associated samples, whichever is higher.

The method blank must have acceptable surrogate recoveries.

Corrective Actions: For DoD projects, if the analyte is a common laboratory contaminant (i.e., acetone, 2-butanone, carbon disulfide and methylene chloride), and written approval has been received, the data may be reported with qualifiers if the concentration of the analyte is less than the reporting limit. For non-DoD if the analyte is a common laboratory contaminant (i.e., methylene chloride, acetone, 2-butanone, ethyl ether, Acetonitrile and hexane) the data may be reported with qualifiers if the concentration of the analyte is less than five times the reporting limit.

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limit.

Reanalysis of samples associated with an unacceptable method blank is required when reportable concentrations are determined in the associated samples.

If there is no target analyte greater than the RL (less than one half the RL for DoD clients) in the samples associated with an unacceptable method blank, the data may be reported with qualifiers for non-DoD clients. For DoD clients the data may only be reported if written approval has been received.

If surrogate recoveries in the blank are not acceptable, the data must be evaluated to determine if the method blank has served the purpose of demonstrating that the analysis is free of contamination. If surrogate recoveries are low and there are reportable analytes in the associated samples, reextraction of the blank and affected samples will normally be required. Consultation with the client should take place.

If reanalysis of the batch is not possible due to limited sample volume or other constraints, the method blank is reported, all affected analytes in the associated samples are flagged as required by the project, and appropriate comments may be made in a narrative to provide further documentation.

#### 9.4 Surrogates

Every sample, blank (including instrument blanks), and QC sample is spiked with surrogates. Surrogate recoveries in samples, blanks, and QC samples must be assessed to ensure that recoveries are within established limits. The compounds included in the surrogate spiking solutions are listed in Table 6.

Acceptance Criteria: Acceptance limits for surrogate recoveries are set at  $\pm$  3 standard deviations around the historical mean or as defined by project or program requirements. Surrogate recovery limits are updated at a fixed frequency by QA and stored in the LIMS.

Corrective Actions: If any surrogates are outside limits, the following corrective actions must take place (except for dilutions):

- Check all calculations for error.
- Ensure that instrument performance is acceptable.
- Recalculate the data and/or reanalyze if either of the above checks reveal a problem.
- Re-prepare and reanalyze the sample or flag the data as "Estimated Concentration" if neither of the above resolves the problem.

The decision to reanalyze or flag the data should be made in consultation with the client. It is necessary to re-prepare/reanalyze a sample only once to demonstrate that poor surrogate recovery is due to matrix effect, unless the analyst believes that the repeated out of control results are not due to matrix effect.

If the surrogates are out of control for the sample, matrix spike, and matrix spike duplicate, then matrix effect has been demonstrated for that sample and repreparation/reanalysis is not necessary. If the sample is out of control and the MS and/or MSD is in control, then reanalysis or flagging of the data is required.

Re-analysis is not necessary if obvious matrix effect is shown in the chromatograms (e.g. a large co-eluting peak with the same quantitation ion, or non-target interferences) or were noted in sample prep (e.g. high percent

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moisture content without moisture correction). A non-conformance memo is generated stating the reason for not re-analyzing the affected sample.

**NOTE:** For LaMP client samples, if the surrogate percent recovery fails, the recovery must be confirmed by re-extraction and reanalysis with the following exceptions:

- The lab has unequivocally demonstrated a sample matrix effect and informed the LaMP client representative.
- The recovery exceeds control limits and all target analytes in the sample are non-detect.
- 9.5 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

An LCS is analyzed for each batch. The LCS is analyzed after the calibration standard and the method blank, and normally before any samples. The LCS contains all of the analytes of interest (see Table 7a) and must contain the same analytes as the matrix spike.

Acceptance Criteria: The LCS recovery and RPD for the control analytes must be within established control limits. Unless otherwise specified in a reference method or project requirements, the control limits are set at  $\pm$  3 standard deviations around the mean of the historical data or based on project/program limits. An LCS that is determined to be within acceptance criteria effectively demonstrates that the analytical system is in control and validates system performance for the samples in the associated batch. Recovery limits are updated at a set frequency by QA and are stored in the LIMS.

If there are a large number of analytes in the LCS, then a specified number of results may fall beyond the LCS control limit (3 standard deviations), but within the marginal exceedance (ME) limits, which are set at  $\pm$  4 standard deviations around the mean of historical data. Marginal exceedances are recognized and allowed by NELAC. The number of marginal exceedances is based on the number of analytes in the LCS, as shown in the following table:

# of Analytes in LCS	# of Allowed Marginal Exceedances
> 90	5
71 – 90	4
51 – 70	3
31 – 50	2
11 – 30	1
< 11	0

If more analytes exceed the LCS control limits than is allowed, or if any analyte exceeds the ME limits, the LCS fails and corrective action is necessary. Marginal exceedances must be random. If the same analyte repeatedly fails the LCS control limits, it is an indication of a systematic problem. The source of the error must be identified and corrective action taken.

For non-DoD projects, if the LCS recovery is high and there are no detections in the associated samples for the affected analytes the data may be reported with qualifiers. For DoD projects the data may only be reported with qualifiers if approval has been received in writing (method notes will contain "3HR" or "Std Var App" to indicate approval has been received).

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<u>Note:</u> For DOD projects, all exceedances of LCS Control Limits, are subject to corrective action. Therefore, all instances of LCS failures including the high bias but not detected in the associated samples scenario, must be investigated. For example and as noted above, the randomness of these failures can be evaluated or the spike solution can be re-verified. When the source of the problem is identified, corrective action is taken or variance from the QSM is requested.

Corrective Actions: If any analyte or surrogate is outside established control limits as described above, the system is out of control and corrective action must occur. Corrective action will normally be re-preparation and reanalysis of the batch.

If the batch is not re-extracted and reanalyzed, the reasons for accepting the batch must be clearly presented in the project records (via NCMs and the case narrative) and in the final report. Examples of acceptable reasons for not reanalyzing might be that the matrix spike and matrix spike duplicate are acceptable, and sample surrogate recoveries are good, demonstrating that the problem was confined to the LCS. This type of justification should be reviewed and documented with the client before reporting.

If re-extraction and reanalysis of the batch is not possible due to limited sample volume or other constraints, the LCS is reported, all associated samples are flagged, and appropriate comments are made in a narrative to provide further documentation.

#### **9.6** Matrix Spike and Matrix Spike Duplicate (MS/MSD)

For each QC batch, analyze a matrix spike and matrix spike duplicate. Spiking compounds and levels are given in Tables 7 and 7a. The selection of the spike solution is dependent on client program requirements. The matrix spike/duplicate must be analyzed at the same base dilution as the unspiked sample, even if the matrix spike compounds will be diluted out. Dilutions (beyond the base dilution if necessary) of MS/MSD analyses are not required unless there are specific client instructions to do so. If necessary, this requirement will be passed to the laboratory through the PM by means of the mechanisms described in section 9.1.3 of this SOP.

- Acceptance Criteria: The MS/MSD recovery for the control analytes must be within established control limits. Unless otherwise specified in a reference method or project requirements, the control limits are set at  $\pm$  3 standard deviations around the mean of the historical data. The relative percent difference (RPD) between the MS and the MSD must be less than the established RPD limit, which is based on statistical analysis of historical data. MS/MSD recovery and RPD limits are updated at a regular frequency by QA and are stored in the LIMS.
- Corrective Actions: If any individual recovery or RPD falls outside the acceptable range, corrective action must occur. The initial corrective action will be to check the recovery of that analyte in the LCS. Generally, if the recovery of the analyte in the LCS is within limits, then the laboratory operation is in control and analysis may proceed. The reasons for accepting the batch must be documented.

If the recovery for any component is outside QC limits for both the matrix spike/matrix spike duplicate and the LCS, the laboratory is out of control and corrective action must be taken. Corrective action will normally include reanalysis of the batch, except in cases where a high bias is indicated and no target is detected above the reporting limit in any associated sample.

If an MS/MSD is not possible due to limited sample, then a LCS duplicate (LCSD) should be analyzed. The RPD between the LCS and LCSD is compared to the established acceptance limit.

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- **9.7** If batch QC samples or trip blanks are re-analyzed to confirm a recovery or result, and an improvement in results would cause the re-analysis to be reported, then the associated client samples must also be re-analyzed. The only exception to this protocol would be if an obvious analytical problem occurred during the initial analysis (i.e. no internal standard added, bent autosampler needle, etc).
- **9.8** Any extra QC that is analyzed in a batch or sequence must be evaluated using the same criteria as the corresponding QC above.

#### 10.0 <u>Procedure</u>

- **10.1** One time procedural variations are allowed only if deemed necessary in the professional judgment of management to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation shall be completely documented using a Nonconformance Memo and approved by a Supervisor or group leader and QA Manager. If contractually required, the client shall be notified. The Nonconformance Memo shall be filed in the project file.
- **10.2** Any unauthorized deviations from this procedure must also be documented as a nonconformance, with a cause and corrective action described.

#### 11.0 <u>Calibration</u>

11.1 Summary

Prior to the analysis of samples and blanks, the GC/MS system must be tuned and calibrated. Tuning is accomplished by analyzing 4-bromofluorobenzene (BFB) to establish that the GC/MS system meets the standard mass spectral abundance criteria. The GC/MS system must be calibrated initially at a minimum of five concentrations to determine the linearity of the response utilizing target calibration standards. The calibration must be verified each twelve-hour time period for each GC/MS system. The use of a separate calibration is required for low level water.

- **11.2** Recommended Instrument Conditions
  - 11.2.1 General

Electron Energy:	70 volts (nominal)
Mass Range:	35–270 amu
Scan Time:	to give at least 5 scans/peak, $\leq$ 1 seconds/scan
Injector Temperature:	200 – 250 °C
Source Temperature:	According to manufacturer's specifications
Transfer Line:	Temperature: 250 – 300 °C
Purge Flow:	40 mL/minute (± 5 mL/min)
Carrier Gas Flow:	1-15 mL/minute, dependent upon column specifications

#### **11.2.2** Gas Chromatograph Temperature Program

The temperature programs vary with the column type and instrumentation used. The GC run program on each instrument should be optimized so that each peak is broad enough to accommodate at least 5 scans across the peak (not counting the scans at the baseline start and end of the peak). The actual individual method parameters used are stored in each individual instrument methods folder on the network and can be referenced there.

#### **11.3** Instrument Tuning

Each GC/MS system must be hardware-tuned to meet the abundance criteria listed below and in Table 8 for a maximum of a 50 ng injection or purging of BFB. Analysis must not begin until these criteria are met. These criteria must be met for each twelve-hour time period for DoD and BP samples. The twelve-hour time period begins at the moment of injection of BFB. It is critical to accurately estimate the number of samples that can be analyzed within the 12-hour window. When a tune isn't analyzed every 12-hours (i.e., samples are

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analyzed outside of the 12-hour window), the event must be documented in a non-conformance memo and corrective action must be taken. Whenever feasible, samples that were analyzed outside of the 12-hour window will be re-analyzed within a new 12-hour window. When reanalysis is not feasible, results for the affected samples can only be reported if it's technically justified (e.g., subsequent tune passes), the data has been qualified, and it's been authorized and accepted by the client. The BFB may be taken from a specified BFB Tune injection or from the CCVIS. In the case of a calibration sequence, a specified BFB Tune must be injected prior to the injection of the first calibration standard. If an acceptable tune is not achieved, the autosampler prepares another tune standard by adding BFB to either the CCVIS or an instrument blank. The autotune process is repeated once. If the subsequent tune attempt fails, one or more of the corrective actions suggested in the Eurofins TestAmerica, Inc. corporate tune policy, CA-Q-QM-002 are to be attempted.

For commercial samples, a BFB tune is required before the calibration. Each 12 hour window is started with the injection of the CCVIS standard.

Mass	Ion Abundance Criteria
95	50-200% of mass 174
96	5 to 9 % of Mass 95
173	Less than 2 % of Mass 174
174	50 to 200 % of Mass 95
175	5 to 9 % of Mass 174
176	Greater than 95 %, but less than 105 % of Mass 174
177	5 to 10 % of Mass 176

#### **11.4** Initial Calibration

- **11.4.1** A series of five or more initial calibration standards is prepared and analyzed for the target compounds. Nominal calibration levels are listed in Table 4. Certain analytes are prepared at higher concentrations due to poor purge performance. The purge volume is 5 mL for standard level waters and 25 mL for low level waters. Other calibration levels and purge volumes may be used depending on the capabilities of the specific instrument or program requirements. Calibration levels may also vary based on analyst discretion in so far as the minimum number of calibration points are met for the curve type utilized (five for average response factor and first order curves, six for second order curves) and the lowest point on the curve is at or below the current Eurofiins TestAmerica Seattle reporting limit.
- **11.4.2** The same purge volume must be used for calibration and sample analysis, and the low level standard must be at or below the reporting limit.
- **11.4.3** It may be necessary to analyze more than one set of calibration standards to encompass all of the analytes required for some tests.
- **11.4.4** Rejection of Calibration Points

Calibration levels below the reporting limit may be removed provided that the minimum number of calibration points are met for the curve type utilized (five for average response factor and first order curves, six for second order curves), and the lowest standard is at or below the Eurofins TestAmerica Seattle reporting limit.

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High point calibration levels may also be removed so far as the minimum number of calibration points are met for the curve type utilized (five for average response factor and first order curves, six for second order curves) and the midpoint of the curve (the ICIS) is not the highest point of the calibration range.

Generally, it is NOT acceptable to remove mid-points from a calibration. If calibration acceptance criteria are not met, the normal corrective action is to examine conditions such as instrument maintenance and accuracy of calibration standards. Any problems must be fixed and documented in the maintenance logbook. Then the calibration standards must be reanalyzed. If, however, there is documented evidence of a problem with a calibration point (e.g. misinjection, poorly sealed vial, etc...) then one point might be rejected, but it is recommended to re-calibrate.

Refer to Corporate SOP GA-Q-S-005, Calibration Curves, for further details.

**11.4.5** Internal Standards

Internal standard calibration is used. The internal standards are listed in Table 5. Target compounds should reference the nearest internal standard. Each calibration standard is analyzed and the response factor (RF) for each compound is calculated using the area response of the characteristic ions against the concentration for each compound and internal standard. See Corporate SOP CA-Q-S-005, for calculation of response factor and other related algorithms.

- **11.4.6** For 8260D the most common target analytes are checked for a minimum response factor for each calibration level. See Table 14 for the compound list and guidance relative response factor criteria. Due to the large number of compounds and differences in instrument operating conditions, some compounds will fail to meet these guidance RFs.
- **11.4.7** If If all of the %RSD values in the calibration are  $\leq 20\%$  for 8260D, then all analytes may use average response factor for calibration. For analytes that fail the RSD criteria, use linear or quadratic curve.
- **11.4.8** If the software in use is capable of routinely reporting curve coefficients for data validation purposes and the necessary calibration reports can be generated, then the analyst should evaluate analytes with %RSD  $\le 15\%$  or  $\le 20\%$  (8260D) for calibration on a curve. If it appears that substantially better accuracy would be obtained using quantitation from a curve, then the appropriate curve should be used for quantitation. The correlation coefficient (r) must be  $\ge 0.990$  for SW-846 and must be  $\ge 0.995$  for DoD clients. For non-linear curves, the coefficient of determination (r<sup>2</sup>) must be  $\ge 0.990$  for both SW-846 and DoD requirements.
- **11.4.9** For 8260D no more than 10% of compounds can fail the 20% RSD/0.990 correlation coefficient requirement. Any individual analyte result that fails the 20% RSD/0.990 correlation coefficient requirement must be flagged or narrated as an estimated concentration.
- **11.4.10** For any analyte non-detect associated with a calibration that fails the 20%RSD/0.990 correlation criteria there must be a demonstration of adequate sensitivity at the quantitation limit. This is achieved by the successful analysis of a CCVL (CCV at the reporting limit) in the same analytical batch. The criterion for the CCVL is detection only but the standard qualitative identification criteria in the method must be met.
- **11.4.11** See Corporate SOP CA-Q-S-005 for information on acceptable initial calibration models and associated algorithms.
- **11.4.12** Initial Calibration Verification (ICV)

Once the initial calibration has been evaluated and determined to be valid, the calibration must be verified with an Initial Calibration Verification (ICV) using a standard prepared from an alternate source. The ICV is generally run at 20 ug/L for standard level water, low-level soil and methanol preserved soil, and 10 ug/L for low level water curves. As the ICV concentration must not be equal to or greater than the highest calibration level, other ICV levels than those previously listed

may be used or multiple levels of ICV may be needed to validate all compounds in the initial calibration curve.

For DoD and LaMP projects each target compound in the ICV must be <20% drift when compared to the initial calibration. The same criteria apply to BTEX and oxygenate compounds in the LaMP program. For 8260D non-DoD and non-LaMP projects, all compounds must be <30% drift when compared to the initial calibration, except for poorly performing compounds listed in Table 11, which must be <55% drift.

For DoD projects analyses may continue if the drift is <30% for identified poor performing analytes with written approval from the client. (Method comment 4PP). See table 11 for the list of indentified poor performers.

For non-DoD and LaMP projects analyses may continue for those analytes that fail the criteria with approval from the client and an understanding that these results would be considered estimates and could be used for screening purposes.

Corrective Action: If the % drift falls outside acceptance criteria, assess the system for possible problems (standard degradation, etc.), re-prepare the verification standard and re-analyze. If the second ICV also fails, corrective action is required (e.g. system maintenance, re-preparing intermediate standards, etc.) and the calibration must be re-prepared and re-analyzed. An acceptable ICV must be achieved before sample analysis. No samples may be run until calibration has been verified. Analytes which do not meet the ICV % drift criteria will be removed from the calibration in the Chrom chromatography software for the method in which the analyte did not meet the method criteria to prevent the reporting of analytes using a deficient calibration curve.

- **11.4.13** If time remains in the 12-hour period initiated by the BFB injection before the initial calibration for DoD and BP Lamp, samples may be analyzed. For non-DoD and non-BP Lamp samples, the sample window can continue with the 12 hour window beginning with the injection of the last ICAL point. Otherwise, proceed to continuing calibration, Section 11.5.
- **11.5** Continuing Calibration
  - **11.5.1** The initial calibration must be verified every twelve hours. For DoD projects the calibration must also be verified with a closing continuing calibration standard (CCVC) at the end of each analytical sequence.
  - **11.5.2** Continuing calibration begins with analysis of BFB for DoD and BP Lamp samples, as described in Section 11.3. Continuing calibration begins with the analysis of the CCVIS for all other projects. If the system tune is acceptable, the continuing calibration standard(s) are analyzed.
  - **11.5.3** For 8260D non-DoD projects, the percent difference or drift (%D) of target and surrogate compounds must be within ± 20% for 80% of the target compounds.
  - **11.5.4** For DoD and LaMP projects, the percent difference or drift (%D) of target and surrogate compounds must be within ± 20% for the opening CCV. The same criteria apply to BTEX, oxygenate and surrogate compounds in the LaMP program.
  - **11.5.5** For DoD projects the percent difference or drift (%D) of target and surrogate compounds must be within ± 50% for the closing CCV (CCVC).
  - **11.5.6** For non-DoD projects the retention time of the internal standards in the continuing calibration standard cannot change by more than 30 seconds (0.5 min) when compared to the most recent multi-point calibration. For DoD projects the retention time of the internal standards in the continuing calibration standard cannot change by more than 10 seconds when compared to the most recent multi-point calibration. The 30 second criteria may only be used for DoD projects if prior written approval is received (method notes will contain "8ISRT" or "Std Var App" to indicate approval has been received). The internal standard areas must not change by more than a factor of 2 (50 200 %) from the mid point standard of the most recent multi-point calibration.
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**11.5.7** If target and/or surrogate compounds do not meet the criteria in Sections 11.5.3 through 11.5.8, the system must be evaluated and corrective action must be taken. The BFB tune and continuing calibration must be acceptable before analysis begins. Extensive corrective action, such as a different type of column, will require a new initial calibration. For non-DoD and LaMP, if two CCVs in a row fail, a new initial calibration must be performed. For DoD two additional consecutive CCVs must be run immediately. If both pass, samples may be reported without reanalysis. If either fails corrective action and re-calibration is required.

#### Corrective Actions:

For non-DoD projects if the CCV recoveries of the target or surrogates compounds exceed their specified limits, and there are no associated sample detections above the RL, the data may be qualified and reported as the system has shown a potentially high bias. For DoD projects, if the CCV recoveries for target compounds exceed their specified limits, and there are no associated sample detections above the RL, the data may be qualified and reported as the system has shown a potentially high bias only if prior approval has been received in writing (method notes will contain "3HR" or "Std Var App" to indicate approval has been received). For all other cases, results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.

**11.5.8** Once the above criteria have been met, sample analysis may begin. Initial calibration average RFs (or the calibration curve) will be used for sample quantitation, not the continuing calibration RFs. Analysis may proceed until 12 hours from the injection of the BFB for DoD and BP Lamp samples or from the injection of the CCVIS for other samples have passed. (A sample desorbed less than or equal to 12 hours after the BFB/CCVIS is acceptable.)

#### 11.6 Sample Preparation

Check the Balance logbook to determine if the daily calibration check has been completed. If it has not, the analyst must perform this check according to SOP TA-QA-0014

- **11.6.1** Sample extraction for Medium-Level Analysis using in house extraction.
  - **11.6.1.1** When extracting the sample, extrude (for 5 g EnCore<sup>™</sup>) or weigh (for 10 g in house soil extraction) the sample into a tared 20 mL scintillation vial. EnCore samples should be extruded into methanol upon receipt. Record scintillation vial lot number, the sample weight, the methanol lot number, the preparation date and the analyst who prepared it in the 5035 preparation batch in TALS. Sample weights are calculated in the laboratory by adding the tare weight of the scintillation vial to the "Tare Weight" column and then entering the weight of the scintillation vial plus sample into the "Vial & Sample" column of the preparation batch sheet for the corresponding sample container ID. This can be done by either a direct read from the balance in the volatiles prep area (preferred method), or by manually entering the weight. If the samples were preserved in MeOH at another TALS lab the calculated initial sample weight can be manually entered into the "Initial Amount" column of the preparation batch sheet for the corresponding sample container ID.
  - **11.6.1.2** For each batch of up to 20 samples a method blank (MB) and a Laboratory Control Sample (LCS) are also extracted. To prepare the method blank (MB); add 10-mL of methanol to 10g Ottawa sand. To prepare the laboratory control sample (LCS)/laboratory control sample duplicate (LCSD), add 160-uL of the 8260 working solution and 10-mL of methanol to 10g muffled Ottawa sand. (NOTE: The same metal spatulas to weigh soil samples must be used for measuring out the Ottawa sand).
  - **<u>11.6.1.3</u>** If sufficient sample is available, one matrix spike (MS)/matrix spike duplicate (MSD) pair is extracted per extraction batch of up to 20 samples. If the sample set

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being extracted consists of products, waste oils, or other sample matrixes which based on analyst experience and discretion would not yield acceptable spike results due to matrix effects, a matrix duplicate (MD) and/or MD/MS may be prepared in lieu of and MS/MSD. To prepare the matrix spike (MS)/matrix spike duplicate (MSD), add 160 uL of the 8260 working solution and 10 mL of methanol to 10 g pre-weighed soil samples.

- **<u>11.6.1.4</u>** Add 5 mL (for EnCore<sup>™</sup> or TerraCore<sup>™</sup>) or 10mL (in house soil extraction) of methanol to all vials immediately after recording sample weight.
- **11.6.1.5** Vortex the samples for the extraction batch for approximately 10 to 30 seconds to break up any large clumps in the extraction vials. This is especially important for extruded samples as they may be compacted in the EnCore<sup>™</sup> or TerraCore<sup>™</sup> sampling device and come out as a pellet. If after 30 seconds a pellet still remains, vortex for an additional 30 seconds. If pellet still remains, further vortex mixing is not recommended, proceed to next step. It should be noted that the MB and LCS must be vortex mixed the same amount of time as the longest associated sample.
- **11.6.1.6** After all samples have been vortex mixed, place all samples for the extraction batch into shaker box and set timer for 10 minutes. It is recommended that the caps of all vials are checked and tightened before placing in shaker box to prevent leaking. If samples are present which still contain pelletized sample after vortex mixing in step 11.6.1.5, set the timer for 10 to 15 minutes. It is not recommended to shake samples for more than 15 minutes. If a sample still contains pelletized sample after shaking for 15 minutes, vortex the sample for an additional 15 seconds and shake entire batch for additional 5 minutes. Any pelletized sample remaining after second shaking is noted in and NCM in the extraction batch.
- **11.6.1.7** After samples are shaken, place samples four at a time into centrifuge with inserts for scintillation vials. Spin samples for a sufficient time to create a transparent but not necessarily uncolored layer of methanol extract above the extracted material. The time will vary depending on the nature and particle size of the extracted material. Three to five minutes at 50% speed is usually sufficient. Again it should be noted that the MB and LCS must be centrifuged at the same rate and for the same time as the longest centrifuged associated sample.
- **11.6.1.8** Medium-level solid extracts are stored in the scintillation vial used for extraction and are stored at 0-6°C. The extracts are removed from cold storage and are allowed to return to ambient temperature prior to analysis.
- **11.6.2** Sample extraction for Medium-Level Analysis, field preserved.
  - **11.6.2.1** Each containers tare weight is recorded in the TALS preparation batch. Most containers will contain a bar code with the tare weight information that can be scanned for automatic entry into the tare weight entry field in the preparation batch. Sample weights are calculated in the laboratory by adding the received weight of the sample jar to the "Vial & Sample" column of the preparation batch sheet for the corresponding sample container ID. This can be done by either a direct read from the balance in the volatiles prep area (preferred method), or by manually entering the weight. If the samples received are in 4 oz jars with 25 mls of methanol (AK samples) the calculated initial weight of the sample must be adjusted to correct for the weight of the methanol which is not included in the container tare weight. TALS will perform this calculation, however the analyst must enter "Yes" into the "Sub MeOH Wgt" column of the preparation batch sheet for the corresponding sample container ID. The nominal amount of initial soil should be 10g for VOA vials with 10mL of methanol, or 25g with 25mL of

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methanol. When the calculated initial weight of the soil deviates by more than 20% of the expected value, high or low, an NCM should be written detailing that the 1:1 ratio of soil:methanol is significantly exceeded. Acceptable weights are 8g-12g for a 10g:10mL sample, and 20g-30g for 25g:25mL sample.

- **<u>11.6.2.2</u>** For each batch of up to 20 samples a method blank (MB) and a Laboratory Control Sample (LCS) are prepared by the laboratory prior to sample analysis. A MB and an LCS sample consists of 10g of muffled Ottawa Sand added to a scintillation vial followed by 10-mL of methanol.
- **11.6.2.3** Add the correct amount of matrix spiking solutions to all LCS samples. An aliquot of 160 uL of the 8260 working solution is added to 10mL extracts. The addition of the spike solutions introduces a slight error, which can be neglected in the calculations. The listed volumes are halved (80 uL) for 5-mL extracts.
- **11.6.2.4** The MB, LCS and any received samples which appear to contain "clumps" of sample which could be broken up with agitation are vortex mixed for up to 1 minute. If no samples require agitation, only the MB and LCS are vortex mixed for approximately 15 seconds to ensure mixing of the sand and added solutions.
- **11.6.3** Sample preparation for Low-Level Analysis EnCore<sup>™</sup>.
  - **11.6.3.1** VOA samples received in EnCores should be extruded into VOA vials with stir bars at time of receipt prior to storage in the freezer. Prior to analysis, low level soil samples collected or extruded to VOA vials with or without water are removed from the freezer and allowed to thaw. Samples should not be allowed to remain at room temperature for more than 30 minutes prior to extrusion into a VOA vial or analysis.
  - **11.6.3.2** The weight of the samples is accurately recorded by either direct connection from the analytical balance to the batch record (preferred method) or by typing the balance reading into the batch record.
  - **<u>11.6.3.3</u>** The extruded sample or the sample received in a VOA vial without water has 5 mls of reagent water added to it.

#### 11.7 <u>Sample Analysis</u>

- **11.8** Preliminary Evaluation
  - **11.8.1** Sample screening

Where possible, samples are screened by headspace or GC/MS off-tune analysis to determine the correct aliquot for analysis. Alternatively, an appropriate aliquot can be determined from sample histories. Refer to section 11.15 for Dilutions.

- **11.9** Sample Analysis Procedure
  - **11.9.1** All analysis conditions for samples must be the same as for the continuing calibration standards (including purge volume, time and flow, desorb time and temperature, column temperatures, multiplier setting etc.).
  - **11.9.2** All samples must be analyzed as part of a batch. The batch is a set of up to 20 samples of the same matrix processed using the same procedures and reagents within the same time period. The batch also must contain a MS/MSD (if sufficient sample volume allows), an LCS, and a method blank.
    - **<u>11.9.2.1</u>** Laboratory generated QC samples (Blank, LCS, MS/MSD) do not count towards the maximum 20 samples in a batch. Field QC samples are included in the batch count.
    - **11.9.2.2** It is not necessary to reanalyze batch QC (except for the method blank) with reanalysis of samples. However, any re-runs must be as part of a valid batch.

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#### **11.10** Water Samples

- **11.10.1** All samples and standard solutions must be at ambient temperature before analysis.
- **11.10.2** For low-level analysis water samples are sub sampled by the autosampler at the appropriate volume (10 mL).
- **11.10.3** For standard level analysis 5 mLs are sub sampled by the autosampler.
- **11.10.4** For both low-level and standard level analysis internal standards and surrogates are added by the autosampler. Refer to Tables 5 and 6.
- **11.10.5** MS/MSD samples are prepared by injecting the 8260 working solution through the VOA vial septa using a bevel tipped syringe or directly into the MS or MSD VOA vial. 4.6 uL are injected for standard level waters and 8.6 ul are injected for low level waters.
- **11.10.6** Purge the sample at ambient temperature with a trap temperature of  $25^{\circ}$ C.
- **11.10.7** After purging is complete, dry purge and desorb the sample, start the GC temperature program, and begin data acquisition. After desorption, bake the trap for 5-10 minutes to condition it for the next analysis. When the trap is cool, it is ready for the next sample.
- **11.10.8** Purge Time, dry purge time, desorb time, bake time, and temperature are optimized for the type of trap in use and the analytical system. The same conditions must be used for samples and standards. Current at the time of writing this SOP, purge time for all instruments is 8 to 11 minutes, dry purge is 0-1 minutes, bake time is 6 to 9 minutes, desorb temperature is 195 to 220°C, and bake temperature is 220 to 270°C.
- **11.10.9** Immediately after analysis or immediately after opening the sealed VOA vial and obtaining the necessary aliquots for dilutions, the analyst must check the pH of aqueous samples with narrow range pH paper to ensure the pH is < 2. Record the pH of aqueous samples and the lot number of the pH paper used on the analytical batch sheets along with any dilution factors used. In those cases where the pH is > 2, initiate a non-conformance report and qualify the data, noting if the sample(s) was analyzed outside of the shortened seven-day hold time or zero-day hold time for aromatics. Where possible, reanalyze should be performed.
- **11.11** TCLP Leach Samples
  - **11.11.1** Follow the instructions for standard level water samples using a 100 times dilution for the method blank, laboratory control sample, and all samples. An MS/MSD pair must be prepared per batch by the method described in section 11.10.6.
  - **11.12** Methanol Extract samples
    - **11.12.1** Fill a VOA vial with reagent water, and remove 900 uL of water using a volumetric pipette.
    - **11.12.2** Add 1075 uL of methanolic extract to the vial and immediately cap the VOA vial invert the vial to ensure that no air bubble larger than 4 mm is present. If there is an air bubble and it is greater than 4 mm, re-prepare sample.
    - **11.12.3** The final volume of reagent water and methanolic extract used is entered into Chrome which then is uploaded into the analytical batch in TALS (43 mls).
    - **11.12.4** As with water samples, internal standards and surrogates are added by the autosampler. Refer to Tables 5 and 6.
    - **11.12.5** Load the sample in the autosampler and proceed to analyze.
    - **11.12.6** MS/MSD samples for in house extracts are prepared at time of extraction and are prepared for analysis as above. For field preserved samples, an in house post spike of the prepared sample is necessary, and is prepared by injecting 8.6 uL of 8260 working solution through the VOA vial septa using a bevel tipped syringe.

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- **11.12.7** Dilutions of methanolic extracts are made by adding proportional amounts of methanol extract to a new VOA vial. This amount is recorded in the initial volume of the sample in the Chrom worklist. Sample dilutions of greater than 5x do not require the removal of water from the VOA vial prior to addition of methanolic extract.
- **11.12.8** Purge the sample at ambient temperature with a trap temperature of 25°C.
- **11.12.9** After purging is complete, dry purge and desorb the sample, start the GC temperature program, and begin data acquisition. After desorption, bake the trap for 5-10 minutes to condition it for the next analysis. When the trap is cool, it is ready for the next sample.
- **11.12.10** Purge Time, dry purge time, desorb time, bake time, and temperature are optimized for the type of trap in use and the analytical system. The same conditions must be used for samples and standards. Current at the time of writing this SOP, purge time for all instruments is 8 to 11 minutes, dry purge is 0-1 minutes, bake time is 6 to 9 minutes, desorb temperature is 195 to 220°C, and bake temperature is 220 to 270°C.
- 11.13 Low-Level Solids Analysis using Discrete Autosamplers
  - **11.13.1** Sample collection and initial preparation for low level soil samples has been discussed in section 8.9 and 11.6.
  - **11.13.2** Internal standards and surrogates is added by the autosampler. Refer to Tables 5 and 6.
  - **11.13.3** MS/MSD samples for low level soil samples are prepared by injecting 2 uL of 8260 Working Solution through the VOA vial septa using a bevel tipped syringe. Direct purge soil analyses are spiked during the preparation of the extraction batch through the septa after capping (as applicable).
  - **11.13.4** Dilutions of low level soil samples are not possible, any analyte that exceeds the calibration range must be E flagged on the appropriate reporting form, NCM filled out, and must be noted in the case narrative. In addition, if sufficient volume was provided, a methanolic extract must be prepared and analyzed.
  - **11.13.5** Purge the sample at ambient temperature with a trap temperature of 25°C.
  - **11.13.6** After purging is complete, dry purge and desorb the sample, start the GC temperature program, and begin data acquisition. After desorption, bake the trap for 5-10 minutes to condition it for the next analysis. When the trap is cool, it is ready for the next sample.
  - **11.13.7** Purge Time, dry purge time, desorb time, bake time, and temperature are optimized for the type of trap in use and the analytical system. The same conditions must be used for samples and standards. Current at the time of writing this SOP, purge time for all instruments is 8 to 11 minutes, dry purge is 1 minute or 2 minutes, bake time is 6 to 9 minutes, desorb temperature is 195 to 220°C, and bake temperature is 220 to 270°C.
- **11.14** Initial Review and Corrective Actions
  - **11.14.1** Retention Times

For DoD projects of 8260D if the retention time for any internal standard in the continuing calibration changes by more than 10 seconds from the mid-level initial calibration standard, the chromatographic system must be inspected for malfunctions and corrected. Reanalysis of samples analyzed while the system was malfunctioning is required.

**11.14.2** Internal Standard Response

If the internal standard response in the daily continuing calibration is more than 200% or less than 50% of the response in the mid-level of the initial calibration standard, the chromatographic system must be inspected for malfunctions and corrected. Reanalysis of samples analyzed while the system was malfunctioning is required.

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The internal standard response in a sample is compared to the internal standard response in the daily continuing calibration. If a sample fails to meet these internal standard criteria, further investigation is necessary. If the change in sensitivity is a matrix effect confined to an individual sample, reanalysis is not necessary, though may be required to prove matrix effect. If the change in sensitivity is due to instrumental problems, all affected samples must be reanalyzed after the problem is corrected. If the ISTD response falls below 50% and the sample has no target analyte detections above the RL (1/2 the RL for DoD projects), the data may be qualified and reported. This should be done in consultation with the PM and client, an NCM must be written.

#### **11.14.3** Surrogate Standard Recoveries

The surrogate standard recoveries are evaluated to ensure that they are within limits. Corrective action for surrogates out of control will normally be to reanalyze the affected samples. However, if the surrogate standard response is out high and there are no target analytes or tentatively identified compounds, reanalysis may not be necessary. Out of control surrogate standard response may be a matrix effect. It is only necessary to reanalyze a sample once to demonstrate matrix effect (this may be demonstrated by a MS/MSD analysis as well). Reanalysis at a dilution should be considered if appropriate. If a diluted analysis is necessary and surrogate recoveries are in control or less affected, this is sufficient to demonstrate matrix interference.

Re-analysis is not necessary if obvious matrix effect is shown in the chromatograms (e.g. a large co-eluting peak with the same quantitation ion, or non-target interferences) or were noted in sample prep (e.g. high percent moisture content without moisture correction). A non-conformance memo is generated stating the reason for not re-analyzing the affected sample.

#### 11.15 Dilutions

Dilutions for waters are made directly into a 40mL VOA vial and should be prepared just prior to the GC/MS analysis of the sample. For example, a 10X dilution is made by filling a VOA vial to slightly overfull and then removing 4.3 mL of reagent water from the vial. 4.3 mL of sample is then transferred to the vial to bring it back to full and it is immediately capped for analysis. In the worklist this is recorded at a 10.0 dilution.

Soil dilutions are prepared by adding a smaller aliquot than the standard 1.075mL or by serial dilution for aliquots smaller than 20uL or viscous samples. In the worklist this is recorded as the amount added to 43 mL. The worklist is left as a 1.0 dilution.

If the response for any compound exceeds the working range of the GC/MS system, a dilution of the sample/extract is prepared and analyzed. A dilution should be prepared to ensure that the majority of compounds being diluted for fall in the middle to upper part of the calibration curve (i.e. from 40-90% of their respective calibration range). All reported dilutions must be within the calibration range of the respective analytes and should be compared to other dilutions to ensure that the diluted data "makes sense" as a check for possible dilution errors. If this cannot be accomplished with a single dilution, multiple sample dilutions may be necessary. Dilution levels should be considered carefully and it is recommended that a "complicated" sample (one which has more than three compounds which require dilution) is discussed with another analyst or area supervisor as necessary in order to minimize the number of dilutions required. Samples may be screened to determine the appropriate dilution for the initial run or historical site data may be used to determine initial dilutions.

#### **11.15.1** Guidance for Dilutions Due to Matrix

If the sample is initially run at a dilution and the baseline rise is less than half the height of the internal standards, or if individual non target peaks are less than twice the height of the internal standards, then the sample should be reanalyzed at a more concentrated dilution. This requirement is approximate and subject to analyst judgment and reasonable client requirements and requests.

#### **11.15.2** Reporting Dilutions

The most concentrated dilution will be reported as the base dilution. Other dilution levels will report only the required diluted compounds and all other compounds and surrogates in the dilution will be set to acceptable in the LIMS system and not reported. Other reporting techniques may be required by specific project requirements or client request and will be transferred to the laboratory by the PM using the mechanisms previously discussed. See Section 9.1.3.

#### 11.15.3 Percent Moisture

Analytical results may be reported as dry or wet weight, as required by the client. Percent moisture must be determined if results will be reported as dry weight. Refer to SOP TA-WC-0125 for determination of percent moisture.

#### **11.16** Instrument Maintenance

- **11.16.1** Agilent 5973 Inert, 5973 Network, 5975, 5975B, 5977, 6890, and 7890
  - **<u>11.16.1.1</u>** All circuit boards and peripheral attachments are dusted and vacuumed of debris and all plumbing and electrical connections inspected and adjusted; any replacement of worn parts is also done at this time.
  - **11.16.1.2** The injection port is cleaned of debris by removing the injector and column nut and forcing clean methanol through the top of the injector into a waste container at the bottom. The inlet liner and gold seal are replaced as needed (e.g. visibly dirty or discolored, active site issues, etc.) The ion source is disassembled, cleaned, and reassembled with new filaments and insulators, if needed.
  - **11.16.1.3** If low level soils cause recoveries for the internal standard to report low or purge flow to decrease in any consequent CCV's, the pencil filters or injector needle could be clogged. Methanol rinses of these parts may solve the issue, or replacing the part.
- **11.16.2** Column installation is performed when the following conditions are encountered;
  - Heavy column bleed that cannot be eliminated by thermal conditioning.
  - Loss of early eluting peaks due to column cutting.
  - Inability to chromatographically resolve method performance compound peaks.
  - Distortion of peak shapes i.e.; broadening, ghost peaks, split peaks that can't be resolved by injection port maintenance or flow control.
  - **<u>11.16.2.1</u>** Turn the GC oven off and let the system cool to room temperature. Remove the column nut, liner, septum, and press tight inlet connector. Dispose of old column appropriately.
  - **<u>11.16.2.2</u>** Cut approximately six inches off of the end of new columns. Install new column using appropriate sized ferrules and nuts.
  - **11.16.2.3** Turn the GC on and set the injector temperature to 230 °C, oven to the manufacturers recommended isotherm temperature or 10°C below the manufacturers max temperature if an isotherm is not provided and condition for five minutes.
  - **11.16.2.4** Perform an air water check on the system. When the air water spectrum shows acceptable levels, proceed with the mass calibration procedure. For additional information of column replacement see the manufacturer's operator's manual.
  - 11.16.3 OI Analytical 4760 and 4660 Purge and Trap Concentrator Units
    - **<u>11.16.3.1</u>** A new OI #10 trap is installed and conditioned by baking at 210 degrees C for at least 30 minutes. An initial conditioning of overnight is recommended as time allows.
    - **<u>11.16.3.2</u>** Sample lines, internal valves, sparge cells, and sparge cell mounts and fittings are rinsed with purge and trap grade methanol or replaced as necessary.

- <u>11.16.3.3</u> All dust and debris is removed from the circuit boards and tubing replaced where necessary.
- **<u>11.16.3.4</u>** The purge gas flow rate (40 mL/min ± 5 mL/min) should be measured at the vent and recorded in the maintenance logbook.
- **11.16.4** OI 4100 or equivalent type autosampler.
  - **<u>11.16.4.1</u>** Remove debris and perform a calibration per manufacturer's instructions.
  - <u>11.16.4.2</u> All dust and debris is removed from the circuit boards and tubing replaced where necessary.
  - **<u>11.16.4.3</u>** The guide rails are wiped down with a Kim wipe and n-propanol to remove grease buildup and debris. Arms, rods, and rails should be removed and all parts cleaned at least once per year, especially bearings.
  - **11.16.4.4** The syringe is cleaned per manufacturer's instructions to remove debris.
  - **11.16.4.5** The rinse reservoir is refilled with purge water prior to analysis.
  - **<u>11.16.4.6</u>** The Internal Standard/Surrogate Standard vial is refilled as needed and primed after filling to ensure the instrument is drawing volume.
- **11.16.5** Major Maintenance

A new initial calibration is necessary following certain maintenance procedures. These maintenance procedures include changing the column, cleaning the source and replacing the multiplier. In addition, a new initial calibration may be necessary if a large amount of routine maintenance occurs at once. This will be determined by evaluating the system using a CCV.

#### **11.16.6** Maintenance Logbook

All maintenance and repairs need to be documented in the instrument's maintenance logbook. The logbook must include the instrument name, serial number for each major component (e.g., GC, autosampler, column) and the date of start-up. When an instrument is not capable of analyzing samples, it needs to be tagged "Out of Service". Logbook entries must include a description of the problem and what actions were taken to address the problem. After an instrument has undergone maintenance or repairs, the system is evaluated using a tune, CCV or ICAL. If the evaluation is successful, the analyst documents in the logbook that the "System returned to control as indicated by a passing CCV" (or ICAL, MB, tune, etc as may be the case).

If columns were replaced during maintenance procedures, the specific make, model and serial numbers of the columns installed need to be entered in the instruments maintenance logbook.

#### **11.17** Troubleshooting

#### 11.17.1 QUESTIONS TO ASK YOURSELF

#### 11.17.1.1 MECHANICAL ISSUE?

- Has the problem just started, or has it been getting worse with time?
- Has anything recently been done to the instrument that may have caused the problem to start?
- Have there been any nasty samples run on the instrument recently?

#### 11.17.1.2 ANALYTE ISSUE?

- Are there any other compounds out or trending out?
- Did the CCV and/or LCS show similar trends?
- Is this a one time event? Or did you see similar signs yesterday?
- Is it failing on other mass specs?
- Did anything change from the last time it passed?

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• Have there been any nasty samples run on the instrument recently?

## 11.17.1.3 INTERNAL/SURROGATE ISSUE?

- Have they been stable up until now?
- Is the gas on and are the standards fresh?
- Are the glass vials correctly positioned and tight?
- Do they look like they are trending in any direction or just fluctuating?
- Is the tune stable? Are the ratios close to the ICAL tune?

#### 11.17.2 BEST PRACTICE

**11.17.2.1** If you can – replace the most likely piece in the system, label the old one with which instrument it's from, the date out and possibly the problem you are having e.g. R1, 071010 Bromoform. Test if the problem is fixed. If not, move onto the next thing and replace until the problem is fixed. Then work backward and reinstall the old pieces which are still OK. If you no longer need a part that is still good, label it as such. If a piece is bad and not even good for testing with throw it out and tell your department manager what piece and part number.

#### **11.17.3** TYPICAL FIRST THINGS TO LOOK AT AND TRY

11.17.3.1 CHECK YOUR FLOWS (For soil mode, purge on archon)

- Set the Archon to purge for 111mins instead of 11mins then set a vial to purge and "pause" the concentrator. This will give ample time to troubleshoot.
- Use the flow meter to check the flow out the purge vent using a small clear tube as an adapter you should have about 40mls.
- Take the transfer line off at the entrance to the concentrator and measure the flow you should also have about 40mls.
- Generally this would suggest you don't have a blockage or a leak, but check the following first
- Find a clear tube that has been blocked at one end, place this on the purge vent while the vial is purging and establish the following:
- Did the bubbles stop straight away <2mins?</p>
- Yes the leak is in the Archon
- Have the bubbles stopped over a 5 7 min period?
  - Yes Most probably not a leak but could be a blockage (which includes the tube you put on the vent)
  - No There is a leak somewhere, most likely the concentrator.
- If there is no soil valve attached then remove the transfer line inlet (to concentrator) fitting and replace with a capped fitting, Run the concentrator full leak check.
- If all of the above passes then you do not have a problem with the flows/blockage/leak.
- Remember to set Archon back to 11mins purge and bake off trap before running again.

## 11.17.3.2 IF YOU HAVE A LEAK

- In the Archon purge a vial and leak check around the top of the needle, the transfer line and the pencil filter in the back of the Archon.
- In the 4100 perform a leak check as described in the operator's manual.
- In the concentrator Perform a leak check in the system diagnostics to determine which part of the system has a leak.
- With a vial purging leak check around all the fittings starting with the entry from the transfer line, the 4-port valve, the 6-port valve ad around the water management and trap.
- You can also check the flows coming out of the 4-port, leaving the 6-port, there is an adapter which can be added instead of the trap to measure through the water management, from the trap. If all of these measures around 40mls and still you have less

than 37 coming out the purge vent it could be leaking across the valves in the side of the concentrator.

• REMEMBER – any Archon that has been changed to Nitrogen will not be able to be checked with the leak detector.

## 11.17.3.3 COMMON PLACE TO LOOK IF IT'S A ANALYTE PROBLEM

- **1,1,2,2-Trichloroethane RRF** Could be any of the lines as often an active site. Start with transfer line, lines in concentrator, water management and trap, soil valve if installed.
- **Bromoform** Flow is not 40mls, water management, transfer line, small lines in concentrator. This can sometime be a tune issue as well if it is somewhat different from normal.
- **Chloromethane carryover** Often the trap, replace the trap and condition at 210°C for 30min.
- Naphthalene carryover/low response Often water management, change this out and condition with 5 or 6 varying concentrations of an old main or 524 std. e.g. 20ppb, 80ppb, 10ppb, 50ppb etc. Could also be transfer line. Perform a sample pathway rinse on the purge and trap concentrator.
- 2-CEVE could be anywhere. Start with transfer line and work way through system, small lines in concentrator, purge needle as last resort. Could also be water management, soil valve if installed.
- **MTBE** often an active site could be transfer line or trap. Sometimes the instrument just needs recalibrating.
- **Vinyl Chloride** Usually the first compound to fail low in the standard mix simply move up to next standard. If you are changing to a new standard every couple of days then your ICAL standards were too fresh and you need to ICAL again.
- **1,1-Dichloroethene** Usually the first compound to fail low in the Main mix simply move up to next standard. If you are changing to a new standard every couple of days then your ICAL standards were too fresh and you need to ICAL again.
- **Chloroform** usually your tune is differing from the ICAL
- **Contamination** look back at previous runs, if you have high hits for this compound then run 20 30 blanks to clean it up. If you still have high concentrations then the sample possibly blew back into the instrument so could be purge valves or the pencil filter in the back of the Archon.
- **Ethylbenzene** usually your tune is differing from the ICAL.

## 11.17.3.4 PEAK SHAPE DIFFERENT

• If you have peak tailing on the front end compounds such as Vinyl Chloride, Chloromethane etc then it is often a result of a worn trap.

#### 11.17.3.5 SURROGATES FAILING

- If you have 1,2-DCA failing and all the other surrogates are OK, then the likely cause is the tune. Often the ratios will have moved. Follow the surrogates, if low, then drop ratios etc
- If you have all the surrogates out and it seems to be consistently that way, it could be the following,
  - Is the gas turned on?
  - Is the surrogate vial positioned properly on the archon
  - Your concentration levels in the ICAL maybe incorrect if you have just ICALed.
  - The valve has perhaps worn a little and the nominal value in target needs to be updated, but this can only happen after an ICAL.
  - If the surrogates need to be weighted linear or linear in an ICAL and you see them trending this way for a while its possible the column has gone bad or you may have a standard valve leak.

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- You can check to see if it's the archon causing the problem by manually injecting IS/SS and turn off the IS and SS on the archon
- If two surrogates are high and two are low, sometimes this is because your Archon surrogate is not matching with the surrogate you ICAL'd with. Try swapping out the Archon surrogate and if this does not fix it, re-ICAL the Supp with the new surrogate.

#### 11.17.3.6 INTERNALS FAILING, TRENDING OR BOUNCING

- How fresh is your internals? If they are more than say a month old, they may have gone bad. Is the vial on properly and done up tight (not too tight).
- Is the gas turned on?
- How long has the instrument been using the current filament? More than 4weeks then you may want to change to the other or change the filaments if they are both spent.
- If the internals bouncing seems to correlate with the tune then most likely you want to change filament or clean the source.
- If the internals fall to a value and sit there or raise to a value and sit there you may want to consider ICAL it at that tune setting, instruments have a kind of sweet spot.
- Internals falling off maybe a water buildup and the parameters need looking at on the concentrator. Have a look at other instruments to see how they are set up and try one or two different settings to establish if this helps. Always keep a note of where they were at and what you have changed them too. Best place to record this is on your sequence and in the white folder under daily changes.
- Split ratios can also effect internals, try increasing the ratio to more like 45:1 if not already at this level.

## 11.17.3.7 CONCENTRATOR STOPS

- Turn it off and on again, it is common for the concentrator to lose the plot every so often.
- Shows a temperature error check to make sure the trap is covered and the main cover is down properly, any heat escape will cause an error.

## 11.17.3.8 SEQUENCE STOPS

- You have started on a file that already exists and you have not checked the overwrite file box.
- Communication problem with the GC and MS. Turn off the MS and GC and restart the computer. Restart the MS and GC.

#### 11.17.3.9 ARCHON STOPS

- Standard home errors syringe already home use the maintenance menu on the archon to step you through cleaning the syringe. Before putting back together smear the inside of the syringe with 'Nose grease'.
- Standard home errors -

## 12.0 Calculations / Data Reduction

- **12.1** Qualitative Identification for Full Scan Analysis
  - 12.1.1 An analyte is identified by retention time and by comparison of the sample mass spectrum with the mass spectrum of a standard of the suspected compound (standard reference spectrum). Mass spectra for standard reference may be obtained on the user's GC/MS by analysis of the calibration standards or from the NIST Library (same library as used for routine sample analysis). Two criteria must be satisfied to verify identification: (1) elution of sample component at the same GC retention time as the standard component; and (2) correspondence of the sample component and the standard component characteristic ions.

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- **NOTE:** Care must be taken to ensure that spectral distortion due to co-elution is evaluated.
- **12.1.1.1** The sample component retention time must compare to within ± 0.06 RRT units of the retention time of the standard component. For reference, the standard must be run within the same twelve hour tune as the sample.
- **12.1.1.2** All ions present in the standard mass spectra at a relative intensity greater than 10% (most abundant ion in the spectrum equals 100%) should be present in the sample spectrum.
- **12.1.1.3** The relative intensities of ions should agree to within  $\pm 30\%$  between the standard and sample spectra. (Example: For an ion with an abundance of 50% in the standard spectra, the corresponding sample abundance must be between 20 and 80%.)
- **12.1.2** If a compound cannot be verified by all the above criteria, but in the technical judgment of the analyst, the identification is correct, then the analyst shall report that identification and proceed with quantitation.
- **12.1.3** All data are subject to two levels of technical review, as described in SOP TA-QA-0635.
- **12.2** Tentatively Identified Compounds (TICs)
  - **12.2.1** If the client requests components not associated with the calibration standards, a search of the NIST library may be made for the purpose of tentative identification. The following guidelines apply:
    - **12.2.1.1** Relative intensities of major ions in the reference spectrum (ions > 10% of the most abundant ion) should be present in the sample spectrum.
    - **12.2.1.2** The relative intensities of the major ions should agree to within 20%. (Example: If an ion shows an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must be between 30% and 70%).
    - **12.2.1.3** Molecular ions present in the reference spectrum should be present in the sample spectrum.
    - **12.2.1.4** lons present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of co-eluting compounds.
    - **12.2.1.5** Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the spectrum because of background contamination or coeluting peaks. (Data system reduction programs can sometimes create these discrepancies.)
    - **12.2.1.6** Computer-generated library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other. Only after visual inspection of the sample with the nearest library searches should the analyst assign a tentative identification. If the TIC requested is part of the list of target analytes, the TIC will not appear under the list of tentatively identified compounds.
    - **12.2.1.7** Once tentative identifications are assigned, these results are uploaded into LIMS with the other data and the TICs are automatically reported to the client from the LIMS.

#### 12.3 Accuracy

<u>ICV / CCV, LCS % Recovery</u> = <u>observed concentration</u> x 100 known concentration

<u>MS % Recovery</u> = (<u>spiked sample</u>) - (<u>unspiked sample</u>) x 100 spiked concentration

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#### 12.4 Precision (RPD)

<u>Matrix Duplicate (MD)</u> = <u>|orig. sample value - dup. sample value|</u> x 100 [(orig. sample value + dup. sample value)/2]

#### 12.5 <u>Response Factor (RF)</u>

$$RF = \frac{A_x C_{is}}{A_{is} C_x}$$

Where:

 $A_x$  = Area of the characteristic ion for the compound to be measured.

A<sub>is</sub> = Area of the characteristic ion for the specific internal standard.

C<sub>is</sub> = Concentration of the specific internal standard, ng.

C<sub>x</sub> = Concentration of the compound being measured, ng.

#### 12.6 Standard deviation (SD)

$$SD = \sqrt{\frac{\sum_{i=1}^{n} (X_i - \overline{X})^2}{n-1}}$$

Where:

 $X_i$  = Value of X at i through n. n = Number of points.  $\overline{X}$  = Average value of Xi.

#### 12.7 Percent relative standard deviation (%RSD)

$$\% RSD = \frac{SD}{\overline{RF}} \times 100\%$$

Where  $\overline{RF}$  is the mean of RF values for the calibration.

## 12.8 Percent drift between the initial calibration and the continuing calibration:

$$\% Drift = \frac{C_{expected} - C_{found}}{C_{expected}} \times 100\%$$

Where:

Cexped

# **12.9** <u>Concentration</u> = mg/kg or L = $C \times V \times D$

Where:

C = sample concentration in extract (ppm)

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V = Volume of extract (mL) D = Dilution Factor

W = Weight/Volume of sample aliquot extracted (grams or mLs)

NOTE: All dry weight corrections are made in LIMS at the time the final report is prepared.

**Note:** For all methanolic samples with a % Moisture of greater than 10%, it is necessary to adjust the extraction final volume of the sample in order to allow for the miscible solvents effect. This is done by the following equation:

Corrected FV = ((g of samples \* % moisture/100) + ml of MeOH) \* 40

In these situations, an "other observation" NCM must be generated and the correction and above formula must be noted in the case narrative.

#### 12.10 Calculation of Results for Methanol Extracts

Sample Conc (ug/Kg) = [On Column (ug/L)] x Extraction Final Volume (mL) x VOA Vial Volume (mL) x 1L (CF) x 1000g (CF) Amount of Soil Sample (g) Amt of MeOH Extract (mL) 1000mL 1Kg

VOA vial volume is 43 ml and when the extract doesn't require a dilution, 1.075 mL of the methanol extract is used. So, the equation becomes:

Sample Conc (ug/Kg) = [On Column (ug/L)] x Extraction Final Volume (mL)  $^{1}$  x  $\frac{43 \text{ (mL)}}{43 \text{ (mL)}}$  x  $\frac{11 \text{ (CF)}}{1000 \text{ (CF)}}$  x  $\frac{1000 \text{ g (CF)}}{1 \text{ M}}$ Amount of Soil Sample (g)  $^{2}$  1.075 (mL) 1000mL 1Kg

<sup>1</sup>Extract Final Volume, miscible solvent corrected (mL) = ((g of samples \* % moisture/100) + ml of MeOH) \* 40 (used when % Moisture of the soil sample is greater than 10%).
<sup>2</sup>Amount of Soil, dry-weight corrected (g) = sample mass (g) \* (100 - % moisture/100)

**12.11** Upon completion of the analytical sequence:

**12.11.1** Review chromatograms online and determine whether manual data manipulations are necessary.

12.11.2 Manual Integrations

All manual integrations must be justified and documented. See Corporate SOP CA-Q-S-002 for requirements for manual integration.

- **12.11.3** Manual integrations may be processed using Chrom, which stores the before and after chromatograms and the reason for the change, and attaches the analyst's electronic signature.
- **12.11.4** Alternatively, the manual integration may be processed manually. In the latter case, print both the both the before and after chromatograms and record the reason for the change and initial and date the after chromatogram. Before and after chromatograms must be of sufficient scale to allow an independent reviewer to evaluate the manual integration.
- **12.11.5** Confirm that run logs have printed on them the instrument ID, the analyst and the method used. If this is not printed on the run logs, this must be entered by hand prior to completing the package.
- **12.12** Compile the raw data for all the samples and QC samples in a batch. The analytical batch is defined as containing no more than 20 field samples.
  - **12.12.1** Perform a level 1 data review and document the review on the data review checklist (GCMS Data Review Checklist).
  - **12.12.2** Submit the data package and review checklist to the peer reviewer for the level 2 review. The data review process is explained in SOP TA-QA-0635.

#### 12.13 <u>Method Performance</u>

#### 12.14 <u>Method Detection Limit Study (MDL)/Detection Limit</u>

The method detection limit (MDL) or detection limit (DL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL/DL is determined according to the laboratory's MDL/DL procedure (see SOP TA-QA-0602). MDL/DLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL/DL studies for analyses performed; these are verified at least quarterly unless method requirements require a greater frequency.

For instruments that run samples which fall under LaMP regulations, a yearly MDL Study must be performed and MDLV starting at 1X the MDL.

#### 12.15 Limit of Detection

The limit of detection (LOD) is determined for each analyte and matrix by spiking a quality system matrix at approximately two to four times the detection limit. This spike concentration establishes the LOD. The LOD is verified quarterly for each method and matrix on each instrument that analyzes said method/matrix. Refer to the laboratory's LOD procedure (see SOP TA-QA-0602)

#### 12.16 Limit of Quantitation

The limit of Quantitation (LOQ) is verified quarterly for each method and matrix on each instrument that analyzed said method/matrix. Refer to the laboratory's LOQ procedure (see SOP TA-QA-0618)

#### 12.17 <u>Demonstration of Capabilities</u>

Analyst initial Demonstrations of Capability (DOC) are performed after completing a read and understand memo for the SOP and before any client samples are analyzed. DOCs are updated annually (continuing DOC). See SOP TA-QA-0617 for details.

#### 12.18 <u>Training Requirements</u>

See SOP TA-QA-0608 for detailed training requirements.

#### 13.0 <u>Pollution Control</u>

It is Eurofins TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention".

#### 14.0 Waste Management

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to Waste Disposal SOP TA-EHS-0036.

#### **14.1** Waste Streams Produced by the Method

- **14.1.1** VOA vials containing acidic water; VOA vials containing extracted acidic water and small amounts of methanol are collected in large plastic satellite waste bins marked "Hazardous Waste." At or before the waste reaches 55 gallons, the contents are transferred to the waste warehouse where the vials are bulked into a 55 gallon waste barrel and sent out for incineration.
- **14.1.2** VOA vials containing extracted soil samples, which will contain small amounts of methanol and possibly sodium bisulfate. Unused sample extracts are held for at least 40 days, in case further testing is deemed necessary. After at least 40 days have passed these sample extracts are transported to the waste room were they are bulked into the flammable liquid loose pack barrel and sent out for incineration.

**14.1.3** Expired Standards. Expired standards are collected in satellite containers marked "Hazardous Waste." At or before the containers reach 55 gallons the containers are taken to the waste warehouse where they are bulked into an expired standards lab pack and sent out for incineration.

#### 15.0 References / Cross-References

- **15.1** Method 8260D, Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), Revision 4, June, 2018, SW-846, <u>Test Methods for Evaluating Solid Waste</u>, <u>Physical/Chemical Methods</u>, Sixth Edition, EPA Office of Solid Waste.
- **15.2** Method 5035A, Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples, Revision 1, July, 2002, SW-846, <u>Test Methods for Evaluating Solid Waste</u>, <u>Physical/Chemical Methods</u>, Third Edition and all promulgated updates, EPA Office of Solid Waste, January 2005.
- **15.3** 40CFR, Part 136, Appendix A (Method 624.1).
- **15.4** U.S. Department of Defense (DoD)/Department of Energy (DOE) Consolidated Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.3, 2019.

#### 16.0 Method Modifications:

ltem	Method	Modification
1	8260D	Storage conditions for standards are listed as <6C or as recommended by manufacturer. TestAmerica Seattle follows 8260B guidelines to store standards at -10C or as recommended by manufacturer.
2	8260D	The minimum RF values for Chloroethane, Acetone, 2-Butanone, 4-Methyl-2-pentanone and 2-Hexanone are based on a lab study and not as listed in the method.
3	5035A	The aliquot of methanol extract taken for analysis is 125 uL rather than the 100 uL specified in Table 1 of the method.

#### 17.0 Tables and Appendices

- Table 1
   TestAmerica Primary Analyte List for 8260D
- Table 2 8260D Additional Analyte List
- Table 3 Appendix IX List
- Table 4 Typical Calibration Levels
- Table 5Internal Standards
- Table 6 Surrogate Standards
- Table 7Full List LCS and Matrix Spike Standard
- Table 8 BFB Key Ion Abundance Criteria
- Table 9Poorly Performing Compounds
- Table 10 Summary of QC Requirements
- Table 11 8260D Guidance Relative Response Factor Criteria

Appendix A Process Flow for Seattle VOA

#### 18.0 Changes from last revision

- Revision 2, dated 9 October 2020
  - Updated approvers
    - Added cut resistant glove requirement, section 5.1.1
    - Updated MeOH storage requirements, section 8.4
- Revision 1, dated 27 January 2020
  - Updated approvers

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- o Updated references to Eurofins TestAmerica throughout
- Removed drinking water references in section 3
- Removed references to 624.1
- Removed sodium bisulfate as a preservative and updated preservation criteria for waters in section
   8
- Added 30 m column in section 6.1
- o Updated autosampler references to OI 4100 throughout
- Updated section 7.2.2 for current procedure of preparing reagent water
- Section 11.4.1 updated to reference Table 4 for initial calibration levels
- Updated 11.6.2.1 for new TALS prep batch procedure
- Added MS/MSD spike levels throughout section 11
- Removed references to TFT surrogate
- Revision 0, dated 22 January 2019
  - o Initial release

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Table 1

## TestAmerica Primary Analyte List for 8260D

## Current reporting limits for all methods may be found in TALS through the following pathway: Global Method Data > Methods > Select Method on left-hand column > Limits View tab > Select Sample Matrix > Select Limit Type "RL"

Compound	CAS Number
Dichlorodifluoromethane	75-71-8
Chloromethane	74-87-3
Bromomethane	74-83-9
Vinyl chloride	75-01-4
Chloroethane	75-00-3
Trichlorofluoromethane	75-69-4
Acetone	67-64-1
Carbon disulfide	75-15-0
Methylene chloride	75-09-2
1,1-Dichloroethene	75-35-4
1,1-Dichloroethane	75-34-3
trans-1,2-Dichloroethene	156-60-5
Methyl tert-butyl ether (MTBE)	1634-04-4
cis-1,2-Dichloroethene	156-59-2
Chloroform	67-66-3
1,2-Dichloroethane	107-06-2
Dibromomethane	74-95-3
2-Butanone (MEK)	78-93-3
1,1,1-Trichloroethane	71-55-6
Carbon tetrachloride	56-23-5
Bromodichloromethane	75-27-4
1,2-Dichloropropane	78-87-5
cis-1,3-Dichloropropene	10061-01-5
Trichloroethene	79-01-6
Dibromochloromethane	124-48-1
1,2-Dibromoethane (EDB)	106-93-4
1,2,3-Trichloropropane	96-18-4
1,1,2-Trichloroethane	79-00-5
Benzene	71-43-2
trans-1,3-Dichloropropene	10061-02-6
Bromoform	75-25-2
4-Methyl-2-pentanone (MIBK)	108-10-1
2-Hexanone	591-78-6

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Table 1

#### TestAmerica Primary Analyte List for 8260D

#### Current reporting limits for all methods may be found in TALS through the following pathway: Global Method Data > Methods > Select Method on left-hand column > Limits View tab > Select Sample Matrix > Select Limit Type "RL"

Compound	CAS Number
Tetrachloroethene	127-18-4
Toluene	108-88-3
1,1,2,2-Tetrachloroethane	79-34-5
Chlorobenzene	108-90-7
Ethylbenzene	100-41-4
Styrene	100-42-5
m- and p-Xylenes	136777-61-2
o-xylene	95-47-6
1,3-Dichlorobenzene	541-73-1
	106-46-7
	95-50-1
	590-20-7
Bromochloromethane	74-97-5
1,1-Dichloropropene	563-58-6
1,3-Dichloropropane	142-28-9
Bromobenzene	108-86-1
n-Propylbenzene	103-65-1
2-Chlorotoluene	95-49-8
4-Chlorotoluene	106-43-4
1,3,5-Trimethylbenzene	108-67-8
tert-Butylbenzene	98-06-6
1,2,4-Trimethylbenzene	95-63-6
sec-butylbenzene	135-98-8
4-Isopropyltoluene	99-87-6
n-Butylbenzene	104-51-8
1,2,4-Trichlorobenzene	120-82-1
Naphthalene	91-20-3
Hexachlorobutadiene	87-68-3
1,2,3-Trichlorobenzene	87-61-6
1,1,1,2-Tetrachloroethane	630-20-6
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8

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Table 1

#### **TestAmerica Primary Analyte List for 8260D**

#### Current reporting limits for all methods may be found in TALS through the following pathway: Global Method Data > Methods > Select Method on left-hand column > Limits View tab > Select Sample Matrix > Select Limit Type "RL"

Isopropylbenzene

98-82-8

Table 2

#### 8260D Additional Analyte List

Compound	CAS Number
Acrolein	107-02-8
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1
lodomethane	74-88-4
2-Chloroethyl vinyl ether <sup>1</sup>	110-75-8
Vinyl acetate	108-05-4
Methyl acetate	79-20-9
2-Methyl-2-propanol	75-65-0
tert-Butyl Ethyl Ether	637-92-3
trans-1,4-Dichloro-2-butene	110-57-6
Total Xylenes	1330-20-7
Acrylonitrile	107-13-1
Hexane	110-54-3
Tetrahydrofuran	109-99-9
Cyclohexane	110-82-7
tert-Amyl Methyl Ether	994-05-8
Methylcyclohexane	108-87-2
cis-1,4-Dichloro-2-butene	1476-11-5
Hexachloroethane	67-72-1
2-Ethyl-1-hexanol	104-76-7
1,3,5-Trichlorobenzene	108-70-3

1 2-Chloroethyl vinyl ether cannot be reliably recovered from acid preserved samples

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Table 3

#### Appendix IX Analyte List

Compound	CAS Number
Acetonitrile	75-05-8
Isopropyl ether	108-20-3
n-Butanol	71-36-3
Methacrylonitrile	126-98-7
Isobutanol	78-83-1
Ethyl ether	60-29-7
Ethyl Acetate	141-78-6

## Table 4

## **Typical Calibration Levels**

	Calibration Levels, μg/L										
Standard level water, Low-level Soil and Methanol preserved soil purge	0.2	0.4	1.0	5.0	10	20	50		100		150
	Calibration Levels, μg/L										
Low level water purge	0.02	0.05	0.10	0.20	0.50	1.0	5.0	10.0	20.0	50.0	100.0

## Table 5

#### **Internal Standards**

Internal Standard	Standard Concentration (mg/L)	Quantitation lon
1,4-Dichlorobenzene-d4	250	152
Chlorobenzene-d5	250	117
Fluorobenzene	250	96

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#### Table 6

## **Surrogate Standards**

Surrogate Compounds	Standard Concentration (mg/L)
1,2-Dichloroethane-d4	150
4-Bromofluorobenzene	150
Dibromofluoromethane	150
Toluene-d8	150

#### NOTES:

1) Recovery and precision limits for the surrogates are generated from historical data and are maintained by the QA department.

Compound	Standard Concentration (mg/L)			
Acrolein	250			
Vinyl acetate	250			
2-Chloroethyl vinyl ether	250			
1,4-Dioxane	1250			
2-Butanone (MEK)	250			
2-Ethyl-1-hexanol	1250			
2-Hexanone	250			
2-Methyl-2-propanol	250			
4-Methyl-2-pentanone (MIBK)	250			
Acetone	250			
Acetonitrile	500			
Acrylonitrile	250			
Bromomethane	250			
Chloroethane	50			
Chloromethane	50			
Cis-1,4-Dichloro-2-butene	50			
Dichlorodifluoromethane	50			
Ethyl acetate	250			

## Table 7 Full List LCS and Matrix Spike Compounds

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Compound	Standard Concentration (mg/L)
Ethyl ether	250
lodomethane	250
Isopropyl ether	50
Methacrylonitrile	250
Methyl acetate	250
Methyl tert-butyl ether	50
Tert-amyl methyl ether	50
Tert-butyl ethyl ether	50
Tetrahydrofuran	250
Trans-1,4-Dichloro-2-butene	250
Trichlorfluoromethane	50
Vinyl chloride	50
1,1,1,2-Tetrachloroethane	50
1,1,1-Trichloroethane	50
1,1,2,2-Tetrachloroethane	50
1,1,2-Trichloro-1,2,2-trifluoroethane	50
1,1,2-Trichloroethane	50
1,1-Dichloroethane	50
1,1-Dichloroethene	50
1,1-Dichloropropene	50
1,2,3-Trichloropropane	50
1,2,4-Trichlorobenzene	50
1,2,4-Trimethylbenzene	50
1,2-Dibromo-3-chloropropane	50
1,2-Dichlorobenzene	50
1,2-Dichloroethane	50
1,2-Dichloropropane	50
1,3,5-Trichlorobenzene	50
1,3,5-Trimethylbenzene	50
1,3-Dichlorobenzene	50
1,3-Dichloropropane	50

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Compound	Standard Concentration (mg/L)
1,4-Dichlorobenzene	50
2,2-Dichloropropane	50
2-Chlorotoluene	50
4-Chlorotoluene	50
4-Isopropyltoluene	50
Benzene	50
Bromobenzene	50
Bromoform	50
Carbon disulfide	50
Carbon tetrachloride	50
Chlorobenzene	50
Chlorobromomethane	50
Chlorodibromomethane	50
Chloroform	50
Cis-1,2-Dichloroethene	50
Cis-1,3-Dichloropropene	50
Cyclohexane	50
Dibromomethane	50
Dichlorobromomethane	50
Ethylbenzene	50
Ethylene Dibromide	50
Hexachlorobutadiene	50
Hexachloroethane	50
Hexane	50
Isobutyl alcohol	5000
Isopropylbenzene	50
Methylcyclohexane	50
Methylene chloride	50
m- & p-Xylene	100
Naphthalene	50
n-Butanol	5000

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Compound	Standard Concentration (mg/L)
n-Butylbenzene	50
n-Propylbenzene	50
o-Xylene	50
sec-Butylbenzene	50
Styrene	50
tert-Butylbenzene	50
Tetrachloroethene	50
Toluene	50
trans-1,2-Dichloroethene	50
trans-1,3-Dichloropropene	50
Trichloroethene	50

#### NOTES:

1) Recovery and precision limits for the LCS, MS, and MSD are generated from historical data and are maintained by the QA department.

#### Table 8

## **BFB Key Ion Abundance Criteria**

Mass	Ion Abundance Criteria
95	50-200% of Mass 174
96	5 to 9 % of Mass 95
173	Less than 2 % of Mass 174
174	50 to 200 % of Mass 95
175	5 to 9 % of Mass 174
176	Greater than 95 %, but less than 105 % of Mass 174
177	5 to 10 % of Mass 176

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Table 9

#### **Poorly Performing Compounds**

Acetone	Isopropyl alcohol
Acetonitrile	Dichlorofluoromethane
Acrolein	1,2-Dibromo-3-chloropropane (DBCP)
Acrylonitrile	1,4-Dioxane
n-Butanol	Ethyl acetate
2-Butanone (MEK)	2-Hexanone
Bromomethane	Methacrylonitrile
Bromoform	Methyl acetate
Carbon disulfide	Methyl methacrylate
2-Chloroethyl vinyl ether	4-Methyl-2-pentanone (MIBK)
Chloroethane	Naphthalene
Chloromethane	2-Nitropropane
Dichlorodifluoromethane	Proprionitrile
cis-1,4-Dichloro-2-butene	Tetrahydrofuran
trans-1,4-Dichloro-2-butene	1,1,2-Trichloro-1,2,2-trifluoroethane
Ethanol	1,2,3-Trichlorobenzene
Ethyl methacrylate	Trichlorofluoromethane
lodomethane	Vinyl acetate
Isobutyl alcohol	Tert butyl alcohol

The laboratory's GC/MS group identified this list of compounds based on current and historical performance. The recovery performance was reviewed against full spike recovery data and method performance data, where available, to validate each compound as a "poor performer." This is not a comprehensive list and is subject to change. Each DoD projects' target analyte list should be evaluated for poor performers.

## Analytes that are in **bold** are also represented in Table 1 Standard Analytes.

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# Table 10Summary of QC Requirements

QC Parameter	Frequency	Acceptance Criteria	Corrective Action		
BFB Tune	Prior to ICAL and at the beginning of each 12-hour period.	See Section 11.3	Retune instrument and verify. Rerun affected samples.		
Minimum 5-point Initial Calibration, 6-point for quadratic curves	Initial calibration prior to sample analysis	For Method 624.1: RSD for RFs: ≤ 35% for all analytes. For Method 8260B: 1. Average Response Factor for SPCCs:	Terminate analysis; correct the problem; recalibrate. Problem must be corrected. No samples may be run until ICAL has passed.		
		≥ 0.30 for chlorobenzene, and 1,1,2,2- tetrachloroethane; ≥ 0.10 for chloromethane, bromoform, and 1,1- dichloroethane			
		<ol> <li>RSD for RFs for CCCs: ≤ 30%</li> </ol>			
		For Method 8260C:			
		<ol> <li>Average Response Factor for specified compounds: See table 14</li> </ol>			
		<ol> <li>RSD for all compounds: ≤ 20%</li> </ol>			
		For DOD requirements above and one option below: Option 1: RSD for each analyte ≤ 15%			
		<u>Option 2</u> : Linear regression least squares regression $r^2 \ge 0.990$			
		<u>Option 3</u> : Non linear least squares regression $r^2 \ge 0.990$ and 6 points must be used.			
ICV	Following initial calibration.	Method control limits of all analytes under method 624.1	Terminate analysis; correct the problem; recalibrate.		

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QC Parameter	Frequency	Acceptance Criteria	Corrective Action
		8260B: ±40% for non- DoD projects and ±55% for poor performers	
		8260C: ±30% for non- DoD projects and ±55% for poor performers	
		For DoD: ±20% recovery and ±30% for poor performers with prior written approval	
Relative Retention Times (RRT)	With each sample	RRT of each target analyte within ± 0.06 RRT units.	Correct problem, then rerun ICAL. Laboratory may update RTs based on the CCV to account for minor performance fluctuations or after routine system maintenance (e.g. column clipping).
CCV	Daily before sample analysis and every 12 hours of analysis time.	<ul> <li>8260B:</li> <li>Avg RF for SPCCs: ≥ 0.30 for chlorobenzene and 1,1,2,2- tetrachloroethene; ≥ 0.10 for chloromethane, bromoform, and 1,1-dichloroethane;</li> <li><u>%D/Drift for CCCs</u> ≤ 20%D.</li> <li><u>%D/Drift for nonCCCs</u> ≤ limits in Table 12.</li> <li>8260C:</li> <li>Avg RF for specified compounds: See table 14</li> <li>%D/Drift for 80% of compounds ≤ 20%D.</li> </ul>	Correct problem, then rerun CCV. If that fails, then repeat ICAL. Reanalyze all sample since the last successful CCV.

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QC Parameter	Frequency	Acceptance Criteria	Corrective Action		
		<ul> <li>For DoD:</li> <li>1. <u>Avg RF</u>: see method</li> <li>2. <u>Opening CCV:</u> <u>%D/Drift for all</u> <u>target compounds</u> <u>and surrogates</u> ≤ 20%D.</li> <li>3. <u>Closing CCV:</u> <u>%D/Drift for all</u> <u>target compounds</u> <u>and surrogates</u> ≤ 50%D.</li> </ul>			
Internal Standards (IS) verification	Every field sample, standard, and QC sample	Retention time ± 30 seconds from RT of the midpoint standard in ICAL; EICP area within -50% to +100% of ICAL midpoint standard. <b>For DoD:</b> Retention time ± 10 seconds from RT of the midpoint standard in ICAL; EICP area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples while system was malfunctioning is mandatory.		
Method Blank	One per batch of 20 field samples or fewer.	The result must be < RL or < 5% the amount measured in any sample or 1/10 the regulatory limit. For DoD: No analytes detected > ½ RL and > 10% the amount measured in any sample or 1/10 the regulatory limit. For common laboratory contaminants no analytes detected > RL.	Re-extract and reanalyze samples. Note exceptions under criteria section. See Section 9.3 for additional requirements.		
LCS	One per batch of 20 field samples or fewer.	Must be within laboratory control limits. <b>For DoD:</b> Must contain all analytes to be reported. QC acceptance criteria specified by DoD.	See Section 9.5 for additional requirements.		

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QC Parameter	Frequency	Acceptance Criteria	Corrective Action		
		if available. Otherwise, use in-house control limits.			
Surrogate All field and QC samples.		Must be within laboratory control limits, unless it fails high and the sample is ND, or matrix interference is confirmed by a reanalysis or MS/MSD performed on the sample, or client specific requirements exist. <b>For DoD:</b> QC acceptance criteria specified by DoD, if available. Otherwise,	See Section 9.4 for additional requirements.		
		use in-house control limits.			
Matrix Spike One per lot of 20 field samples or fewer.		Must be within laboratory control limits.	See Section 9.5 for additional requirements.		
		For DoD: Must contain all analytes to be reported and must use LCS control limits. MD/MSD RPD ≤20%			

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Table 11

#### 8260D Guidance Relative Response Factors Criteria for Initial and Continuing Calibration Verification

Analyte	Relative Response Factor (RF) a.
Acetone	0.010
Benzene	0.200
Bromochloromethane	0.100
Bromodichloromethane	0.300
Bromoform	0.100
Bromomethane	0.010
2-Butanone	0.010
Carbon disulfide	0.100
Carbon tetrachloride	0.100
Chlorobenzene	0.400
Chloroethane	0.010
Chloroform	0.300
Chloromethane	0.010
Cyclohexane	0.010
Dibromochloromethane	0.200
1,2-Dibromo-3-chloropropane	0.010
1,2-Dibromoethane (EDB)	0.200
1,2-Dichlorobenzene	0.600
1,3-Dichlorobenzene	0.500
1,4-Dichlorobenzene	0.600
Dichlorodifluoromethane	0.010
1,1-Dichloroethane	0.300
1,2-Dibromoethane	0.070
1,1-Dichloroethene	0.060
cis-1,2-Dichloroethene	0.200
trans-1,2-Dichloroethene	0.100
cis-1,3-Dichloropropene	0.300
trans-1,3-Dichloropropene	0.300
Ethylbenzene	0.400
2-Hexanone	0.010
Isopropylbenzene	0.400
Methyl Acetate	0.010
4-Methyl-2-pentanone	0.030
Methyl tert-Butyl Ether	0.100
Methylcyclohexane	0.050
Methylene chloride	0.010
Styrene	0.200
1,1,2,2-Tetrachloroethane	0.200
Tetrachloroethene	0.100
Toluene	0.300
1,2,3-Trichlorobenzene	0.400
1,2,4-Trichlorobenzene	0.400
1,1,1-Trichloroethane	0.050
1,1,2-Trichloroethane	0.200
1,1,2-Trichlorotrifluoroethane	0.050
Trichloroethene	0.200
Trichlorofluoromethane	0.010
Vinyl chloride	0.010
m.p-Xylene	0.200
o-Xylene	0.200

a. Values in this table are referenced from the CLP Statement of Work SOM 02.4. These response factors are provided as guidance only and are not intended to be a requirement..

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Analysis	Client Sub List Desc	Method	Matrix	Preservative	Container	Volume Required	Holding Time
EDB, DBCP, and 1,2,3-TCP (GC)	EDB, DBCP, and 1,2,3-TCP (GC)	8011	Solid	None	Soil jar 4oz	20 g	14 Days
Metals (ICP/MS)	Cd, Cr, Pb, Ni, Zn	6020B	Solid	None	Clear Glass 4oz Wide - unpreserved	20 g	180 Days
Northwest - Semi-Volatile Petroleum Products (GC)	NWTPH-Dx DRO and RRO	NWTPH_Dx	Solid	None	Soil jar 4oz	30 g	14 Days
Northwest - Volatile Petroleum Products (GC/MS)	NWTPH-Gx	NWTPH_Gx_MS	Solid	Methanol	Voa Vial 40ml - 10mL MeOH	80 mL	14 Days
Percent Moisture	Percent Moisture	Moisture	Solid	None	Soil jar 4oz	20 g	180 Days
Polychlorinated Biphenyls (PCBs) by Gas Chromatography	PCBs - Standard List	8082A	Solid	None	Soil jar 4oz	30 g	1 Year
Semivolatile Organic Compounds (GC/MS SIM)	Polycyclic Aromatic Hydrocarbons	8270E_SIM	Solid	None	Soil jar 4oz	0 g	14 Days
Volatile Organic Compounds by GC/MS	Volatiles, standard list	8260D	Solid	Methanol	Voa Vial 40ml - 10mL MeOH	80 mL	14 Days
EDB, DBCP, and 1,2,3-TCP (GC)	EDB, DBCP, and 1,2,3-TCP (GC)	8011	Water	None	Voa Vial 40ml - unpreserved	80 mL	14 Days
Metals (ICP/MS)	Cd, Cr, Pb, Ni, Zn	6020B	Water	Nitric Acid	Plastic 250ml - with Nitric Acid	100 mL	180 Days
Northwest - Semi-Volatile Petroleum Products (GC)	NWTPH-Dx DRO and RRO	NWTPH_Dx	Water	Hydrochloric Acid	Amber Glass 250mL - hydrochloric acid	250 mL	14 Days
Northwest - Volatile Petroleum Products (GC/MS)	NWTPH-Gx	NWTPH_Gx_MS	Water	Hydrochloric Acid	Voa Vial 40ml - Hydrochloric Acid	80 mL	14 Days
Polychlorinated Biphenyls (PCBs) by Gas Chromatography	PCBs - Standard List	8082A	Water	None	Amber Glass 250ml - unpreserved	250 mL	1 Year
Semivolatile Organic Compounds (GC/MS SIM)	Polycyclic Aromatic Hydrocarbons	8270E_SIM	Water	None	Amber Glass 250ml - unpreserved	500 mL	7 Days
Volatile Organic Compounds by GC/MS	Volatiles, standard list, low level	8260D_LL	Water	Hydrochloric Acid	Voa Vial 40ml - Hydrochloric Acid	120 mL	14 Days

BGES, INC.

APPENDIX C FIELD NOTES

5/11/21 party cloudy 0810 R. Pollock on site 0830 ESN on site. 0919 5B1-10-2 ft water at 1.5 ft brown, sand, fine; with gravel, fine to coarse; trace sitt. 0930 installed temp well MWI 1014 5B2-1 0-2 A dry, brown 1022 no odor sand, fine; with organics Hother SB3-1 0-2 ft (1.5' recovery) moist at 1.5', brown, no odor sand, fine; trace silt. 1101 SB4-1 0-2 ft moist at 1.8' briwn, no odor, sound, fine trace organics. no sample. Rite in the Rain.



1129 585-1 0-2 Ft moist at 1.8 ft, brown, no odor sand, fine ; trace silt. no sample SB6-TRP 1130 Talked to Ali Furmall (Ecology). She approved using a peristaltic pump for the water samples because the bladder pump is not purging any water. 139 SB6-1 0-5 ft (2.5' recovery) moist at 2 ft. brown. no odor. Sand, fine, little silt, trace inganics 1151 SB7-1 0-2 Ft (1.5' recovery) moist at 1.9 Ft. brown, no ador Sand, fine; little silt. no sample.
1206 Collected water sample MWI-OSII From MWI and 1219 duplicate MW2-0511 collected from MWI. 1252 588-1 0-2 ft (1.7' recovery) moist at 1.6 ft. brown. no odor 1256 5B9-1 0-2 ft (1.8' recovery) moist at 1.2 Ft. brown. no odor. no sample. 1305 SB10-1 0-2 Ft. (2'reavery) dry. brown, ho odor. sand, fine; little organics. 1310 SBII-1 0-2 ft, (2' recovery)

Same as SBIO. no Sample. 1300 Mayor Logan onsite. Rite in the Rain.

1320 5B12-1 0-2 ft (2' recovery) wat at 1.8° brown, no odor. sand, fine; trace sitt. no sample. 1415 Collected sample HW3 from Monitoring Well MW3. 1435 SB13-1 0-SFt. (3'recovery) saturated at 2 Feet. brown. no odor. sand, fine; trace organics a silt. 1440 5B14-1 0-2 Ft. (1.4'recovery) brown. dry. no ofor no sample. 1447 SB15-1 0-2.Ft. (2'recovery) brown. no odor. wet at 1 foot. sand fine; little sitt; trace organice. 1450 SB16-1 0-2 A. (15 revovery) wet at 1.1 foot. brown. no odor sitt. no sample. organics trace

J		IJ	U	l	U	L
1453	5B17-1	0-	2 ===	. (1.6	o reco	very
w	set at 1	.2-1	7. 5	nown	. no	odor.
5	cime as	SE	366-	1.00	san	ple.
1530	Surveye	du	vell	5	1 	× 1 1
	TOC	1	Gn	bund	1	1 1 1 1
MWI	3' 3.º	1	3'	(e.7)		21
MW3	3'6.8		3'	2.6		
MW4	4'2.8	,	4'	5.6	•	
1 10		210	-		1	8: 1
ileio	5B18-1	0 4	0-5	A	(3.3'	e coverz
1 1 9	dry. ligt	At 1	orow	n . 1	no	odor
	no son	nple	. 50	and, -	fine	
11017	5B18-1	5	-10	A (3	.5' re	iovery)
	same	as	abo	ve.		1 1

1625 SB19-1 O-SFt (3.5' recovery) dry. light brown. no odor. Sand, fine. no scimple Rite in the Rain.

PID Readings (ppm) SBI 0 11 0.1 12 0.2 2 0.1 3 0.2 13 0.2 4 0 14 0.1 5 0 15 . 0-1 6 0 16 0.1 7 0 17 0.1 8 0 0.1 18 1 -9 0.1 1.2.0 0 19 0 10 0 discondition 10 20 0 Well # 1 3 

1632 SB19-2 5-10ft (3.2 Rowing) dry. light brown. no odor. sand, fine. no sample. 1641 SB20-0 0-5A. (2.5' recovery) dry. brown. no odor. sandfire. 1650 5820-1 5-10 Ft. (3.1' recovery) dry. brown. no odor. sand, fine; trace sitt. SB20-2: duplicate of SB20-1. 1710 Collected water sample from MW4 (MW4-0511) Driller removed all well casings. Left potentiallycontaminated soil and water in drums by fence at NE corner

of the site. offsite for day. Rite in the Rain.

BC ENVIRON SOIL BORING	SE MENT	S, ING	C. NTS	CLIENT: PROJECT:	BGES, INC SOIL BORING City of Othe Truman Prope	LOG Alo rty SOIL BORING LOCATION:
Date:	5/	11/21	_	Weather Cond	ditions:	SUNNY 72°F
Start/End:			_	Drilling Comp	pany/Rig Type:	ESN/LAR
Observer:	R.	Pollock	_	Drilling/Samp	ling Method:	Direct Push (Macrobare
Sample Number		Depth (feet)	PID (ppm) Amb/H.S.	Recovery		Description
SB1-1	From: Time:	0 to: 2 0919	NCO	2	sand, fine; wi brown. no odi	th gravel, fine to coarse; trace silt.
	From: Time:	to:			end of	boring
	From: Time:	to:				
je i je	From: Time:	to:				
	From: Time:	to:				
	From: Time:	to:				



Page 1 of

Laurence and an and a second second					BGES, IN SOIL BORING	IC. G LOG
BG	ìE	SIN	C	CLIENT:	City of othe	llo
ENVIRON	IMEN	FAL CONSULTA	NTS	PROJECT:	Iniman Prop	erty
SOIL BORIN	G NUM	BER: 582	_			SOIL BORING LOCATION:
Date:	9	11/21		Weather Con	nditions:	SUNNY 72°F
Start/End:			_	Drilling Com	pany/Rig Type:	ESN/LAR
Observer:	R.	Pollock	_	Drilling/Sam	pling Method:	Direct Push / Macro Core
Sample Number		Depth (feet)	PID (ppm) Amb/H.S.	Recovery		Description
	From:	0 to: 2	NC	1	Sand fine :	atte presize dus biorbes boadas
562-1	Time:	1014	0.1	2	Jana Inver	Min organics. ang: Spown, noodor.
	From:	to:			e	ind of boring
	Time:					5
	From:	to:				
	Time:					
	From:	to:		1		
	Time:					
	From:	to:	17			
	Time:					
	From:	to:	/			
	Time:					
	From:	to:	1			
	Time:					
	From:	to:	/			
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
Notes: Amb = ar	nbient; I	H.S. = headspace; NC	C = not collected			

L				BGES, IN SOIL BORING	G LOG		
BG	ES. INC	С.	CLIENT:	City of othe	llo		
ENVIRON	IMENTAL CONSULTAN	NTS	IROJECI.	- Truman Prop	SOU DODING LOCATION		
SOIL BORIN	GNUMBER: 5B3	_			SOIL BORING LOCATION:		
Date:	5/11/21	-	Weather Con	ditions:	Sunny 72°F		
Start/End:			Drilling Com	pany/Rig Type:	ESN/LAR		
Observer:	R. Pollock	-	Drilling/Samp	oling Method:	Direct Push/Macrocore		
Sample Number	Depth (feet)	PID (ppm) Amb/H.S.	Recovery		Description		
1021	From: O to: 2	NC	1.6	sand, fine; t	race sitt.		
563-1	Time: 1022	0.2	1.5	brown. no od	or, moist at 1.5 feet.		
	From: to:		1	ena	d of boring		
	Time:				0		
	From: to:						
	Time:						
	From: to:						
	Time:						
	From: to:						
	Time:						
	From: to:	/					
	Time:						
	From: to:		1				
	Time:						
	From: to:	/	1				
	Time:						
	From: to:	/					
	Time:						
	From: to:	/					
	Time:						
	From: to:	/					
	Time:	/					
	From: to:						
	Time						
Notes: Amb = a	mbient; H.S. = headspace; NC	= not collected	1				

DC			BGES, INC. SOIL BORING LOG			
BG	AES, IN	IC.	PROJECT: TOURGO PODDECT			
ENVIRONMENTAL CONSULTANTS					SOIL BORING LOCATION.	
SOIL BORIN	G NUMBER: SBL	Ł				
Date:	5/11/21		Weather Con	ditions:	Sunny 72°F	
Start/End:			Drilling Com	pany/Rig Type:	ESN/LAR	
Observer:	R. Pollock		Drilling/Sam	pling Method:	Direct Rush/Macrocore	
Sample Number	Depth (feet)	PID (ppm) Amb/H.S.	Recovery		Description	
col .	From: O to: 2	- NC	1	sand, fine;	trace organics	
204-1	Time: 1101	0	2	brown no o	dor. moist at 1.8 feet. no sample.	
	From: to:		/	en	al of boring	
	Time:				a of roung	
	From: to:	1/				
	Time:					
	From: to:	1 /	1			
	Time:					
	From: to:					
	Time					
	From: to:					
	T.'					
	From: to:					
	Time:					
	From: to:					
	Time:					
	From: to:					
	Time:					
	From: to:					
	Time:					
	From: to:	17				
	Time:					
	From: to:					
	Time					
Notes: Amb = a	mbient; H.S. = headspace;	NC = not collected	1			
	1,					

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Lange and the second se					BGES, IN SOIL BORING	C. G LOG
BG	F	S IN	C	CLIENT:	City of othe	110
ENVIROU			<b>U</b> .	PROJECT:	Truman Prop	erty
SOIL BORIN	G NUM	BER: <u>SBS</u>	-			SOIL BORING LOCATION:
Date:	51	11/21	-	Weather Con	ditions:	Sunny 72°F
Start/End:		·····	_	Drilling Com	pany/Rig Type:	ESN/LAR
Observer:	R.	Pollock	_	Drilling/Samp	oling Method:	Direct Rish / Macro Core
Sample Number		Depth (feet)	PID (ppm) Amb/H.S.	Recovery		Description
ac 1	From:	0 to: 2	NL		sand, fine; -	trace sitt, moist at 1.8 feet.
565-1	Time:	1129	0	2	brown no oc	dor. no sample.
	From:	to:	/		Pice	l at having
	Time:					- ob boung
	From:	to:	/			
	Time:					
	From:	to:	K-7			
	Time					
	From:	to:				
	Time					
	From:	to:			,	
	Time					
	From:	to:				
						-
	Time:	4				
	FIOM:	10:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				-
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
Notes: Amb = a	mbient; H	I.S. = headspace; NC	= not collected	1	*	

Law and Law and		<u></u>			BGES, IN SOIL BORING	C. G LOG
BC	SES	S INI	C	CLIENT:	City of othe	110
ENVIRON	IMENTAL	CONSULTA	V.	PROJECT:	Thiman pro	operty
SOIL BORIN	G NUMBER	: <u>SB6</u>	_			SOIL BORING LOCATION:
Date:	5/11	121		Weather Con	ditions:	Suppy 72°F
Start/End:			_	Drilling Com	pany/Rig Type:	ESN/LAR
Observer:	R.Po	llock	_	Drilling/Samj	oling Method:	Direct Rush (Macrocore
Sample Number	De	pth (feet)	PID (ppm) Amb/H.S.	Recovery		Description
SB6-1	From: C	to: 5	NC	2.5	sand, fine; lit	He sitti trace organics. moist at 2 feet.
	From:	to:	K°,		brown. no od	dor.
	Time:				en	d of boring
	From:	to:	$\langle \rangle$			~
	Time:					
	From:	to:	/ /			
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	Prom:	to:				
Notes: Amb	Time:	m hoodenees 210				
Compl	eted	eneadspace; NC	nton'ng	well	MW3. Dept	h to water = 1.75 feet
L		a na sa				

La construction of			and Martine			BGES, IN SOIL BORIN	INC. NG LOG		
BG	ίE	S,	INC	С.	CLIENT: <u>City of Othello</u> PROJECT: Thiman Property				
ENVIRON	IMENT	AL CONS	SULTAN	ITS		1	SOIL BORING LOCATION:		
SOIL BORING	G NUME	BER: S	BT						
Date:	51	11/21			Weather Cond	litions:	Sunny 72°F		
Start/End:					Drilling Comp	any/Rig Type:	ESNTLAR		
Observer:	R.	Pollo	CK		Drilling/Samp	ling Method:	Direct Push / Macrocore		
Sample Number		Depth (fee	t)	PID (ppm) Amb/H.S.	Recovery		Description		
(07.1	From:	O to:	2	NC	10	sand, fine;	little silt. moist at 1.9 feet.		
501-1	Time:	1151		0	1.9	brown. no	adar. no sample.		
	From:	to:				en	d of boring.		
	Time:						с J		
	From:	to:							
	Time:								
	From:	to:		/					
	Time:								
	From:	to:		/					
	Time:								
	From:	to:		/					
	Time:								
	From:	to:	teretaine en algal de merado						
	Time:								
	From:	to:							
	Time:								
	From:	to:							
	Time								
	From:	to:							
	Time			/					
	From:	to:							
	Time						1		
	From:	to:		K					
Notes: Amb =	Time:	H.S. = head	space: NO	= not collecte	d	L			
		- noad							

Language and the					BGES, I SOIL BORIN	NC. NG LOG
BG	ìE	S, IN	C.	CLIENT: PROJECT:	City of Ot	hello
ENVIRON	IMENT.	AL CONSULTA	NTS			SOIL BORING LOCATION.
SOIL BORIN	G NUMI	BER: SB8	_			SOIL BORING LOCATION:
Date:	_5	11/21	-	Weather Cond	ditions:	Sunny 72°F
Start/End:			_	Drilling Comp	pany/Rig Type:	ESN/LAR
Observer:	R.	Pollock	-	Drilling/Samp	oling Method:	Direct Push I Macrolore
Sample Number		Depth (feet)	PID (ppm) Amb/H.S.	Recovery		Description
C20 .	From:	0 to: 2	NC	1 . 7	sand, fine;	trace sitt moist at 1.6 feet.
288-1	Time:	1252	0.1	1.1	brown, no	odor.
	From:	to:		1	en	1 of boring
	Time:					i o o i i o
	From:	to:	1			
	Time:					
	From:	to:	1/			
	Time:					
	From:	to:				
	Time:					
	From:	to:	/		********	
	Time:					
	From:	to:	/			
	Time:					
	From:	to:	/			
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:			*****	
	Time:					
	From:	to:				
	Time:					
Notes: Amb = a	mbient; H	.S. = headspace; NC	c = not collected	I		

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DC					BGES, IN SOIL BORING	ic. G LOG
RG	i上	S, INC	C.	CLIENT: PROJECT:	City of Other	llo
ENVIRON	IMENT	AL CONSULTAI	NTS			SOIL BORING LOCATION:
SOIL BORIN	G NUM	BER: $SB9$	-			
Date:	51	11/21	-	Weather Con	ditions:	Sunny 72°F
Start/End:			_	Drilling Com	pany/Rig Type:	ESN/LAR
Observer:	R.	Pollock	-	Drilling/Samj	pling Method:	Direct Rish / Macrolore
Sample Number		Depth (feet)	PID (ppm) Amb/H.S.	Recovery		Description
100 1	From:	0 to: 2	NC	1.8	Sand, fine; t	race sitt, moist at 1.2 feet.
309-1	Time:	1296	0.1	(-0	brown. no oc	dar. no sample.
	From:	to:		1	er	nd of boring
	Time:					0
	From:	to:		1		
	Time:					
	From:	to:		1		
	Time:					
	From:	to:		1		
	Time:					
	From:	to:				
	Time:					
	From:	to:	/			
	Time:					
	From:	to:	/			
	Time:					
	From:	to:	/	1		
	Time:					
	From:	to:	/			
	Time:					
	From:	to:	/			
	Time:		/			
	From:	to:	/			
	Time:					
Notes: Amb = ar	nbient; H	H.S. = headspace; NC	= not collected	1		

La constanting	<u></u>				BGES, IN SOIL BORING	C. G LOG
BG	ίE	S, IN	C.	CLIENT: PROJECT:	City of Othe Thuman Poppe	ello
ENVIRON	IMENT	AL CONSULT	ANTS		prope	SOIL BODING LOCATION:
SOIL BORIN	G NUM	BER: SBI	0			SOIL BORING LOCATION:
Date:	51	11/21		Weather Con	ditions:	Sunny 72°F
Start/End:				Drilling Com	pany/Rig Type:	ESN/LAR
Observer:	p.	pollock	_	Drilling/Samp	oling Method:	Direct push/Macrocare
Sample Number		Depth (feet)	PID (ppm) Amb/H.S.	Recovery		Description
COID 1	From:	0 to: 2	NC		sand, fine; 11	Hie organics; trace silt don.
51510-1	Time:	1305	0	2	brown. no	o odor.
	From:	to:	/		P.	nd at baring
	Time:				~	an of brang
	From:	to:	1/			
	Time:					
	From:	to:	1 /			
	Time:					
	From:	to:	1-7			
	Time:					
	From:	to:	17			
	Time:					
	From:	to:	1 /			·
	Time					
	From:	to:	K			
	From:	to:				
	Time:	to	K,			
	PTOM:	10:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
Notes: Amb = a	mbient; I	H.S. = headspace; N	IC = not collected		**************************************	

				BGES, INC. SOIL BORING LOG				
BC	λE	S. IN	C.	CLIENT: <u>City of Othello</u>				
ENVIRO	NMENT	AL CONSULTAI	NTS	PROJECT:	Truman prop	erty		
SOIL BORIN	IG NUM	BER: SBII	_			SOIL BORING LOCATION:		
Date:	5/	11/21	_	Weather Con	ditions:	Sunny 72°F		
Start/End:			_	Drilling Com	pany/Rig Type:	ESN/LAR		
Observer:	R.	Pollock	_	Drilling/Sam	pling Method:	Direct Push/Macrocove		
Sample Number		Depth (feet)	PID (ppm) Amb/H.S.	Recovery		Description		
5311-1	From:	0 to: 2	NC	1 1	sand, fine; li	He organics trace silt. dm.		
	Time:	1310	0.1	14	brown. No o	dor. no sample.		
	From:	to:			end	of boring		
	Time:					8		
	From:	to:						
	Time:							
	From:	to:		1				
	Time:							
	From:	to:	/					
	Time:							
	From:	to:	/					
	Time:							
	From:	to:						
	Time:							
	From:	to:						
	Time:							
	From:	to:						
	Time:							
	From:	to:						
	Time:							
~	From:	to:						
	Time			-				
	From:	to:						
	Time			-				
Notes: Amb = a	mbient; H	.S. = headspace; NC	= not collected					

DC		0				BGES, IN SOIL BORING	C. GLOG
BG	ュヒ	5	, IN(	C.	CLIENT: PROJECT:	City of Othe Things Prop	ectu
ENVIRON	IMENT	ALCO	ONSULTAN	NTS			SOIL BORING LOCATION:
SOIL BORIN	G NUM	BER:	SB12	-			Sold Borking Location.
Date:	5/	11/2	21	-	Weather Cond	ditions:	Sunny 72°F
Start/End:				_	Drilling Com	pany/Rig Type:	ESN/LAR
Observer:	R.	Poll	lock	-	Drilling/Samp	oling Method:	Direct Rish / Macrocore
Sample Number		Depth	(feet)	PID (ppm) Amb/H.S.	Recovery		Description
012-1	From:	0	to: 2	NC		sand, fine, tr	ace silt. wet at 1.8 feet.
SBIZI	Time:	13-	20	0.2	2	brown no or	tor, no sample.
	From:		to:			end	1 bound
	Time:					~~~~~	of noting
	From:		to:	1			
	Time:						
	From:		to:				
	Time						
	From:		to:	K			
	From:		to:	K			
	l'iom.						
	Time:						
	From:		to:				
	Time:						
	From:		to:				
	Time:						
	From:		to:				
	Time:						
	From:		to:				
	Time:						
	From:		to:				
	Time						
	From:		to:				
Notes: $Amb = a$	Time:	HS = h	eadspace. NC	= not collected			
notes. Allo – a	morent, 1	u.o. – II	causpace, INC	, not conected			

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BC ENVIRON SOIL BORING	AES, IN IMENTAL CONSULTA GNUMBER: SB12	C. NTS	CLIENT: PROJECT:	BGES, INC. SOIL BORING LOG <u>City of Athello</u> <u>Truman Property</u> SOIL BORING LOCATION:
Date:	5/11/21	_	Weather Cond	nditions: <u>Sunny 72°F</u>
Start/End:		_	Drilling Comp	npany/Rig Type: ESN/LAR
Observer:	R. Pollock	_	Drilling/Samp	pling Method: Direct Purch / Macholove
Sample Number	Depth (feet)	PID (ppm) Amb/H.S.	Recovery	Description
5B13-1	From: 0 to: 5 Time: 1435	NC 0.2	3	sand, fine; trace organics and sitt, wet at 2 feet. brown. no odor.
	From: to: Time:			end ob boring
	From: to: Time:			



				BGES, INC SOIL BORING	C. G LOG
BG	ES, INC	C. P	CLIENT: PROJECT:	City of Othel Truman proper	lo ty
ENVIRON	GNUMBER: SB14	NTS			SOIL BORING LOCATION:
Date:	5/11/21	v	Weather Condi	itions:	Sunny 72°F
Start/End:		E	Drilling Compa	any/Rig Type:	ESN/LAR
Observer:	R. Pollock	E	Drilling/Sampl	ing Method:	Direct Rush / Macro Cove
Sample Number	Depth (feet)	PID (ppm) Amb/H.S.	Recovery		Description
5214-1	From: 0 to: 2	NC	1.4	sand, fine; littl	e organics. dry.
	Time: 1440	0.1		brown. no od	lor. no sample.
	Time:			end	of boring
	From: to:				~
	Time:				
	From: to:				
	Time:				
	From: to:				
	Time:				
	From: to:			dy <u>elan en de antre en en</u>	
	Time:				
	From: to:				
	Time:				
	From: to:				
	Time:				
	From: to:				
	Time:				
	From: to:				
	Time:				
	From: to:				
	Time:				
	From: to:				
	Time:				
Notes: Amb =	ambient; H.S. = headspace; N	C = not collected			

6					BGES, IN SOIL BORING	C. G LOG		
BG	ìE	S, IN	C.	CLIENT: PROJECT:	CLIENT: <u>City of Othello</u> PROJECT: Truchan Property			
ENVIRON	IMENT	AL CONSULTA	NTS			SOIL BORING LOCATION:		
SOIL BORIN	G NUM	BER: <u>5815</u>	_					
Date:	_51	11/21	_	Weather Con	ditions:	Sunny 72°F		
Start/End:			_	Drilling Com	pany/Rig Type:	ESNILAR		
Observer:	R.	pollock	-	Drilling/Samp	oling Method:	Direct Rush / Macrocore		
Sample Number	15	Depth (feet)	PID (ppm) Amb/H.S.	Recovery		Description		
SR15-1	From:	0 <sup>to:</sup> 2	NL	2	sand, fine; litt	le silt; trace organizs; wet at ifoot.		
5015 1	Time:	1447	0.1		brown. no ode	or.		
	From:	to:			er	nd of boring.		
	Time:							
	From:	to:						
	Time:							
	From:	to:	/					
	Time:							
	From:	to:						
	Time:							
	From:	to:						
	Time:							
	From:	to:						
	Time							
	From:	to:						
	Time: From:	to.						
	Time:	to:						
	FIOII.	10.						
	Time:							
	From:	to:						
	Time:							
	From:	to:						
	Time:							
Notes: Amb = an	nbient; I	H.S. = headspace; NC	= not collected					

BG	iΕ	S, INC	С.	CLIENT: PROJECT:	BGES, ING SOIL BORING City of Othe Truman Propert	c. slog ilo
ENVIRON	IMENT	AL CONSULTAN	NTS			SOIL BORING LOCATION:
Date:	5/	11/21	_	Weather Cond	ditions:	Sunny 72°F
Start/End:			_	Drilling Com	pany/Rig Type:	ESNILAR
Observer:	R.	Pollock	-	Drilling/Samp	oling Method:	Direct Push/Macro Core
Sample Number		Depth (feet)	PID (ppm) Amb/H.S.	Recovery		Description
	From:	0 to: 2	NC	16	sand, fine; w	ith organics; trace silt. Wet at 1.1 foot.
5316-1	Time:	1450	0.1	(.)	brown no o	dor. no sample.
	From:	to:			end.	of boring.
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:	/			
	Time:					
	From:	to:		**************************************		
	Time:					
	From:	to:	/			
	Time:					
Notes: Amb = a	mbient;	H.S. = headspace; NC	C = not collected	1		

Page 1 of \_

6					BGES, IN SOIL BORING	C. G LOG
BC-	F	S INC	2	CLIENT:	City of othe	10
ENIVIDOR				PROJECT:	Thinkan Prope	erty
SOIL BORING	CNUM	REP. SQ17				SOIL BORING LOCATION:
Date:	_5	11/21		Weather Con	ditions:	Sunny 72°F
Start/End:				Drilling Com	pany/Rig Type:	ESN/LAR
Observer:	R.	Pollock	-	Drilling/Samp	oling Method:	Direct Rush / Macro Core
Sample Number		Depth (feet)	PID (ppm) Amb/H.S.	Recovery		Description
CBD-1	From:	D to: 2	NC	1.,	sand, fine; with	th organics; trace silt. wet at 1.2 foot.
5011-1	Time:	1453	0.1	1.6	brown, no odi	or. No samples.
	From:	to:	/	1	pind	1 barine.
	Time:				evia	of brang
	From:	to:				/~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
	Time:					
	From:	to:				
	TT:					
	From:	to	K			
		ισ.				
	Time:	an an air an				
	From:	to:				
	Time:					
	From:	to:		1		
	Time:					
	From:	to:	/		*******	***************************************
	Time:					
	From:	to:				
	Time		/			
	From:	to:				
			/			
	Time:	to	K,			
	FIOM.	10.				
	Time:					
	From:	to:				
	Time:					
Notes: Amb = a	mbient; l	H.S. = headspace; NC	= not collected	d		

C					BGES, IN SOIL BORING	C. G LOG
BGFS INC			CLIENT: City of othello			
ENVIRON	IMENTAI	CONSULTAI	NTS	PROJECT:	Truman Pro	perty
SOIL BORING	G NUMBE	R: SBIS	2			SOIL BORING LOCATION:
Date:	5/11	121	_	Weather Cond	ditions:	SUNNY 72°F
Start/End:			_	Drilling Com	pany/Rig Type:	ESN/LAR
Observer:	R.P	bllock	_	Drilling/Samp	oling Method:	Direct Rish / Macrocore
Sample Number	D	epth (feet)	PID (ppm) Amb/H.S.	Recovery		Description
	From: Z	to: 5	NC/	1	sand fine	In light brown ho odor.
SB18-0	Time:	-	0	3,3	no sample.	ingen provide de d
5318-1	From: C	5 <sup>to:</sup> 10	NCO	3,5	sand, fine. a	dry. light brown. no odor.
	From:	to:	1		<i>P.10</i>	d at Imiac
	Time:				Cre	a of wound
	From:	to:	$\square$			
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
	From:	to:				
	Time:					
Notes: Amb = ar	nbient; H.S	. = headspace; NC	= not collected			

Page 1 of 1

	Contraction of the					BGES, I SOIL BORD	INC. NG LOG
BG	ίE	S	, IN	C.	CLIENT: PROJECT:	City of OH Truman Pr	operty
SOIL BORING	MENT G <b>NUM</b>	BER:	SBIC	1			SOIL BORING LOCATION:
Date:	5	111/	21		Weather Con	ditions:	Sunny 72°F
Start/End:					Drilling Com	pany/Rig Type:	ESN/LAR
Observer:	R.	Pol	Lock		Drilling/Sam	pling Method:	Direct Rush/Macrocove
Sample Number		Depth	(feet)	PID (ppm) Amb/H.S.	Recovery		Description
SB19-1	From: Time:	D	to: 5	NCO	3.5	sand, fine, no sample.	dry. light brown. no odor.
SB19-2	From: Time:	5	to: 10	NCO	3.2	sand, fine.	dny. light brown. no odar.
	From:		to:			e	ind 06 boying
	From:		to:	1/			
	Time:						
	Time:		to:	/			
	From:		to:	1/			
	Time:				1		
	Time:		10.	/			
	From:		to:	1/			
	Time:						
	From:	19 1 <u>9</u> -	to:	/			
	From:		to:	1			
	Time:						
	From:		to:	/			
-	From:		to:		1		
Notes: Amb = a	Time:	H S =	headsnace. N	VC = not collecte	4		

				BGES, IN SOIL BORING	C. G LOG		
BC	<b>JES</b> . IN	C.	CLIENT:	- City of oth	ello		
ENVIRO	NMENTAL CONSULTA	NTS	INOJECI.	Innnan Pro	perty		
SOIL BORIN	IG NUMBER: SB2	2			SOIL BORING LOCATION:		
Date:	5/11/21	_	Weather Con	aditions:	Sunny 72°F		
Start/End:		-	Drilling Com	pany/Rig Type:	ESN/LAR		
Observer:	R. Pollock	_	Drilling/Sam	pling Method:	Direct Rush / Macro Lore		
Sample Number	Depth (feet)	PID (ppm) Amb/H.S.	Recovery		Description		
SB20-0	From: 0 to: 5 Time:	NCO	2.5	sand, fine. dn	1. brown. no odor. no sample.		
SB20-1	From: 5 to: 10 Time: 1650	NCO	3.1	Sand, fine; tra	ce silt. dry. brown. no odor.		
	From: to:			end	(of boing		
	From: to:						
	Time:						
	From: to:						
	Time:						
	From: to:						
	Time:						
	From: to:						
	Time:						
	From: to:						
	Time:						
	From: to:						
	Time:						
	From: to:			······································			
	Time:						
	From: to:						
	Time:		t i				
-	From: to:						
	Time:		F				
Notes: Amb = an	nbient; H.S. = headspace; NC	= not collected					

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BGES, INC.

## APPENDIX D LABORATORY ANALYTICAL DATA

# 🛟 eurofins

## Environment Testing America

## **ANALYTICAL REPORT**

Eurofins TestAmerica, Spokane 11922 East 1st Ave Spokane, WA 99206 Tel: (509)924-9200

### Laboratory Job ID: 590-15130-1

Client Project/Site: Othello, WA Revision: 1

## For:

BGES, Inc. 126 SW 148th Street Suite C100-267 Seattle, Washington 98166

Attn: Rose Pollock

Candre Arrington

Authorized for release by: 6/21/2021 5:05:03 PM

Randee Arrington, Lab Director (509)924-9200 Randee.Arrington@Eurofinset.com



Expert

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Visit us at:

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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#### Job ID: 590-15130-1

#### Laboratory: Eurofins TestAmerica, Spokane

#### Narrative

#### Revision 06/21/2021

The following sample ID's were revised due to login error: MW1-0511 (590-15130-1), MW2-0511 (590-15130-2), MW3-0511 (590-15130-3), MW4-0511 (590-15130-4). An extra dash was used in the sample ID's.

#### Receipt

The samples were received on 5/13/2021 10:00 AM. Unless otherwise noted below, the samples arrived in good condition, and where required, properly preserved and on ice. The temperatures of the 2 coolers at receipt time were 2.6° C and 5.4° C.

#### **Receipt Exceptions**

The following sample was listed on the Chain of Custody (COC) for method 8011; however, no sample was received: Trip Blank (590-15130-18).

#### GC/MS VOA

Method NWTPH-Gx: The continuing calibration verification (CCV) associated with batch 590-31715 recovered above the upper control limit for Gasoline. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported. The following samples are impacted: SB1-1-0511 (590-15130-7), SB2-1-0511 (590-15130-8), SB3-1-0511 (590-15130-9), SB6-1-0511 (590-15130-10), SB8-1-0511 (590-15130-11), SB10-1-0511 (590-15130-12), SB13-1-0511 (590-15130-13), SB15-1-0511 (590-15130-14), SB18-1-0511 (590-15130-15), SB20-1-0511 (590-15130-16), SB20-2-0511 (590-15130-17) and Trip Blank (590-15130-18).

Method NWTPH-Gx: The continuing calibration verification (CCV) associated with batch 590-31709 recovered above the upper control limit for Gasoline. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported. The following samples are impacted: MW1-0511 (590-15130-1), MW2-0511 (590-15130-2), MW3-0511 (590-15130-3), MW4-0511 (590-15130-4), Trip Blank (590-15130-5) and (590-15130-H-1 DU).

Method 8260D: The continuing calibration verification (CCV) associated with batch 580-356713 recovered above the upper control limit for Chlorodibromomethane, Bromoform, and Trichlorofluoromethane. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported. The associated samples are impacted: MW1-0511 (590-15130-1), MW2-0511 (590-15130-2), MW3-0511 (590-15130-3), MW4-0511 (590-15130-4) and Trip Blank (590-15130-5).

Method 8260D: The laboratory control sample (LCS) and / or laboratory control sample duplicate (LCSD) for analytical batch 580-356713 recovered outside control limits for the following analytes: Carbon tetrachloride, Dichlorobromomethane, Chlorodibromomethane, Dichlorodifluoromethane, 1,1-Dichloroethene, Bromoform, and Trichlorofluoromethane. These analytes were biased high in the LCS and were not detected in the associated samples; therefore, the data have been reported.

Method 8260D: The following samples were collected in a properly preserved vial; however, the pH was outside the required criteria when verified by the laboratory. The sample was analyzed within the 7-day holding time specified for unpreserved samples: MW4-0511 (590-15130-4).

Method 8260D: The following sample was diluted due to the nature of the physical matrix: MW4-0511 (590-15130-4). Elevated reporting limits (RLs) are provided.

Method 8260D: The continuing calibration verification (CCV) associated with batch 580-356791 recovered above the upper control limit for Vinyl chloride. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported. The associated samples are impacted: MW1-0511 (590-15130-1) and (CCVIS 580-356791/3).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

#### GC/MS Semi VOA

Method 8270E SIM: The RPD of the laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) for preparation batch 590-31643 and analytical batch 590-31630 recovered outside control limits for the following analytes: Pyrene.

Method 8270E SIM: The method blank for preparation batch 590-31643 and analytical batch 590-31630 contained Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene and Benzo[a]pyrene above the method detection limit. This target analyte concentration was less than half the reporting limit (1/2RL); therefore, re-extraction and re-analysis of samples was not performed.

#### Job ID: 590-15130-1 (Continued)

#### Laboratory: Eurofins TestAmerica, Spokane (Continued)

Method 8270E SIM: Surrogate recovery for the following sample was outside control limits: MW3-0511 (590-15130-3). Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

Method 8270E SIM: Surrogate recovery for the following sample was outside control limits: SB13-1-0511 (590-15130-13). Evidence of matrix interference is present; therefore, re-extraction and/or re-analysis was not performed.

Method 8270E SIM: The following sample was diluted due to the nature of the sample matrix: SB3-1-0511 (590-15130-9). Elevated reporting limits (RLs) are provided.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

#### GC Semi VOA

Method NWTPH-Dx: Detected hydrocarbons appear to be due to heavily weathered diesel and/or biogenic interference in the following sample: MW4-0511 (590-15130-4).

Method NWTPH-Dx: Detected hydrocarbons appear to be a complex mixture of diesel and oil range components in the following sample: SB3-1-0511 (590-15130-9).

Method NWTPH-Dx: Detected hydrocarbons appear to be due to oil as well as biogenic interference in the following samples: SB8-1-0511 (590-15130-11) and SB10-1-0511 (590-15130-12).

Method 8011: The matrix spike / matrix spike duplicate (MS/MSD) recoveries for preparation batch 590-31728 and analytical batch 590-31734 were outside control limits. Sample matrix interference and/or non-homogeneity are suspected because the associated laboratory control sample (LCS) recovery was within acceptance limits.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

#### Metals

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

#### General Chemistry

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

#### **Organic Prep**

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

#### VOA Prep

No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

## Sample Summary

Client: BGES, Inc. Project/Site: Othello, WA

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Asset ID	
590-15130-1	MW1-0511	Water	05/11/21 12:06	05/13/21 10:00		A
590-15130-2	MW2-0511	Water	05/11/21 12:19	05/13/21 10:00		
590-15130-3	MW3-0511	Water	05/11/21 14:15	05/13/21 10:00		5
590-15130-4	MW4-0511	Water	05/11/21 17:16	05/13/21 10:00		5
590-15130-5	Trip Blank	Water	05/11/21 00:00	05/13/21 10:00		
590-15130-6	Trip Blank	Water	05/11/21 00:00	05/13/21 10:00		
590-15130-7	SB1-1-0511	Solid	05/11/21 09:19	05/13/21 10:00		
590-15130-8	SB2-1-0511	Solid	05/11/21 10:14	05/13/21 10:00		
590-15130-9	SB3-1-0511	Solid	05/11/21 10:22	05/13/21 10:00		
590-15130-10	SB6-1-0511	Solid	05/11/21 11:39	05/13/21 10:00		8
590-15130-11	SB8-1-0511	Solid	05/11/21 12:52	05/13/21 10:00		
590-15130-12	SB10-1-0511	Solid	05/11/21 13:05	05/13/21 10:00		9
590-15130-13	SB13-1-0511	Solid	05/11/21 14:35	05/13/21 10:00		
590-15130-14	SB15-1-0511	Solid	05/11/21 14:47	05/13/21 10:00		
590-15130-15	SB18-1-0511	Solid	05/11/21 16:18	05/13/21 10:00		
590-15130-16	SB20-1-0511	Solid	05/11/21 16:50	05/13/21 10:00		
590-15130-17	SB20-2-0511	Solid	05/11/21 16:50	05/13/21 10:00		
590-15130-18	Trip Blank	Solid	05/11/21 00:00	05/13/21 10:00		

### Qualifiers

GC/MS VOA		
Qualifier	Qualifier Description	
*+	LCS and/or LCSD is outside acceptance limits, high biased.	
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.	
GC/MS Sem	i VOA	
Qualifier	Qualifier Description	
*1	LCS/LCSD RPD exceeds control limits.	
В	Compound was found in the blank and sample.	
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.	
S1-	Surrogate recovery exceeds control limits, low biased.	
S1+	Surrogate recovery exceeds control limits, high biased.	
GC Semi VO	Α	
Qualifier	Qualifier Description	
F1	MS and/or MSD recovery exceeds control limits.	
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.	
Metals		
Qualifier	Qualifier Description	
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.	
Glossary		

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

## **Definitions/Glossary**

Client: BGES, Inc. Project/Site: Othello, WA

## **Glossary (Continued)**

Abbreviation	These commonly used abbreviations may or may not be present in this report.
TNTC	Too Numerous To Count

Eurofins TestAmerica, Spokane

#### Client Sample ID: MW1-0511 Date Collected: 05/11/21 12:06 Date Received: 05/13/21 10:00

loh	١D·	590-151	30-1
100	ID.	290-121	50-

## Lab Sample ID: 590-15130-1

Matrix: Water

Method: 8260D - Volatile Org	ganic Compo	unds by GC	/MS							
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac	5
1,1,1,2-Tetrachloroethane	ND		0.30	0.038	ug/L			05/17/21 18:07	1	
1,1,1-Trichloroethane	ND		0.20	0.025	ug/L			05/17/21 18:07	1	6
1,1,2,2-Tetrachloroethane	ND		0.20	0.056	ug/L			05/17/21 18:07	1	
1,1,2-Trichloroethane	ND		0.20	0.070	ug/L			05/17/21 18:07	1	
1,1-Dichloroethane	ND		0.20	0.025	ug/L			05/17/21 18:07	1	
1,1-Dichloroethene	ND		0.20	0.035	ug/L			05/17/21 18:07	1	8
1,1-Dichloropropene	ND		0.20	0.036	ug/L			05/17/21 18:07	1	
1,2,3-Trichlorobenzene	ND		0.50	0.15	ug/L			05/17/21 18:07	1	Q
1,2,3-Trichloropropane	ND		0.20	0.050	ug/L			05/17/21 18:07	1	
1,2,4-Trichlorobenzene	ND		0.50	0.17	ug/L			05/17/21 18:07	1	
1,2,4-Trimethylbenzene	ND		0.30	0.072	ug/L			05/17/21 18:07	1	
1,2-Dibromo-3-Chloropropane	ND		2.0	0.44	ug/L			05/17/21 18:07	1	
1,2-Dichlorobenzene	0.047	J	0.30	0.038	ug/L			05/17/21 18:07	1	
1,2-Dichloroethane	ND		0.20	0.043	ug/L			05/17/21 18:07	1	
1,2-Dichloropropane	ND		0.20	0.060	ug/L			05/17/21 18:07	1	
1,3,5-Trimethylbenzene	ND		0.50	0.15	ug/L			05/17/21 18:07	1	
1,3-Dichlorobenzene	ND		0.30	0.050	ug/L			05/17/21 18:07	1	
1,3-Dichloropropane	ND		0.20	0.025	ug/L			05/17/21 18:07	1	
1,4-Dichlorobenzene	ND		0.30	0.050	ug/L			05/17/21 18:07	1	
2,2-Dichloropropane	ND		0.50	0.060	ug/L			05/17/21 18:07	1	
2-Chlorotoluene	ND		0.50	0.12	ug/L			05/17/21 18:07	1	
4-Chlorotoluene	ND		0.30	0.050	ug/L			05/17/21 18:07	1	
4-Isopropyltoluene	ND		0.50	0.15	ug/L			05/17/21 18:07	1	
Benzene	ND		0.20	0.030	ug/L			05/17/21 18:07	1	
Bromobenzene	ND		0.20	0.038	ug/L			05/17/21 18:07	1	
Bromoform	ND		0.50	0.16	ug/L			05/17/21 18:07	1	
Bromomethane	ND		0.50	0.062	ug/L			05/17/21 18:07	1	
Carbon tetrachloride	ND		0.20	0.025	ug/L			05/17/21 18:07	1	
Chlorobenzene	ND		0.20	0.025	ug/L			05/17/21 18:07	1	
Chlorobromomethane	ND		0.20	0.025	ug/L			05/17/21 18:07	1	
Chlorodibromomethane	ND		0.20	0.055	ug/L			05/17/21 18:07	1	
Chloroethane	ND		0.50	0.096	ug/L			05/17/21 18:07	1	
Chloroform	ND		0.20	0.030	ug/L			05/17/21 18:07	1	
Chloromethane	ND		0.50	0.068	ug/L			05/17/21 18:07	1	
cis-1,3-Dichloropropene	ND		0.20	0.090	ug/L			05/17/21 18:07	1	
Dibromomethane	ND		0.20	0.062	ug/L			05/17/21 18:07	1	
Dichlorobromomethane	ND		0.20	0.060	ug/L			05/17/21 18:07	1	
Dichlorodifluoromethane	ND		0.40	0.13	ug/L			05/17/21 18:07	1	
Ethylbenzene	ND		0.20	0.030	ug/L			05/17/21 18:07	1	
Ethylene Dibromide	ND		0.10	0.025	ug/L			05/17/21 18:07	1	
Hexachlorobutadiene	ND		0.50	0.067	ug/L			05/17/21 18:07	1	
lsopropylbenzene	ND		1.0	0.19	ug/L			05/17/21 18:07	1	
Methyl tert-butyl ether	ND		0.30	0.070	ug/L			05/17/21 18:07	1	
Methylene Chloride	ND		5.0	1.2	ug/L			05/17/21 18:07	1	
m-Xylene & p-Xylene	ND		0.50	0.12	ug/L			05/17/21 18:07	1	
Naphthalene	ND		1.0	0.22	ug/L			05/17/21 18:07	1	
n-Butylbenzene	ND		1.0	0.23	ug/L			05/17/21 18:07	1	
N-Propylbenzene	ND		0.30	0.091	ug/L			05/17/21 18:07	1	
o-Xylene	ND		0.50	0.15	ug/L			05/17/21 18:07	1	

Eurofins TestAmerica, Spokane

Vinyl chloride

#### Client Sample ID: MW1-0511 Date Collected: 05/11/21 12:06 Date Received: 05/13/21 10:00

## Lab Sample ID: 590-15130-1

05/18/21 17:57

1

Matrix: Water

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
sec-Butylbenzene	ND		1.0	0.17	ug/L			05/17/21 18:07	1
Styrene	ND		1.0	0.19	ug/L			05/17/21 18:07	1
tert-Butylbenzene	ND		0.50	0.26	ug/L			05/17/21 18:07	1
Tetrachloroethene	ND		0.50	0.084	ug/L			05/17/21 18:07	1
Toluene	ND		0.20	0.050	ug/L			05/17/21 18:07	1
trans-1,3-Dichloropropene	ND		0.20	0.092	ug/L			05/17/21 18:07	1
Trichlorofluoromethane	ND		0.50	0.043	ug/L			05/17/21 18:07	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	102		80 - 120					05/17/21 18:07	1
4-Bromofluorobenzene (Surr)	101		80 - 120					05/17/21 18:07	1
Dibromofluoromethane (Surr)	104		80 - 120					05/17/21 18:07	1
Toluene-d8 (Surr)	99		80 - 120					05/17/21 18:07	1
Method: 8260D - Volatile O	rganic Compou	unds by G	C/MS - RA						
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.20	0.055	ug/L			05/18/21 17:57	1
trans-1,2-Dichloroethene	ND		0.20	0.033	ug/L			05/18/21 17:57	1
Trichloroethene	ND		0.20	0.066	ug/L			05/18/21 17:57	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	95		80 - 120		05/18/21 17:57	1
4-Bromofluorobenzene (Surr)	103		80 - 120		05/18/21 17:57	1
Dibromofluoromethane (Surr)	103		80 - 120		05/18/21 17:57	1
Toluene-d8 (Surr)	99		80 - 120		05/18/21 17:57	1

0.020

0.013 ug/L

#### Method: NWTPH-Gx - Northwest - Volatile Petroleum Products (GC/MS)

ND

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline	ND		150	70	ug/L			05/22/21 01:29	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	98		68.7 - 141					05/22/21 01:29	1

#### Method: 8270E SIM - Semivolatile Organic Compounds (GC/MS SIM)

Analyte Result	Qualifier RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1-Methylnaphthalene ND	0.087	0.022	ug/L		05/17/21 12:25	05/17/21 14:28	1
2-Methylnaphthalene ND	0.087	0.043	ug/L		05/17/21 12:25	05/17/21 14:28	1
Acenaphthene ND	0.087	0.021	ug/L		05/17/21 12:25	05/17/21 14:28	1
Acenaphthylene ND	0.087	0.016	ug/L		05/17/21 12:25	05/17/21 14:28	1
Anthracene ND	0.087	0.024	ug/L		05/17/21 12:25	05/17/21 14:28	1
Benzo[a]anthracene ND	0.087	0.012	ug/L		05/17/21 12:25	05/17/21 14:28	1
Benzo[a]pyrene ND	0.087	0.012	ug/L		05/17/21 12:25	05/17/21 14:28	1
Benzo[b]fluoranthene ND	0.087	0.024	ug/L		05/17/21 12:25	05/17/21 14:28	1
Benzo[g,h,i]perylene ND	0.087	0.020	ug/L		05/17/21 12:25	05/17/21 14:28	1
Benzo[k]fluoranthene ND	0.087	0.015	ug/L		05/17/21 12:25	05/17/21 14:28	1
Chrysene ND	0.087	0.0097	ug/L		05/17/21 12:25	05/17/21 14:28	1
Dibenz(a,h)anthracene ND	0.087	0.013	ug/L		05/17/21 12:25	05/17/21 14:28	1
Fluoranthene ND	0.087	0.016	ug/L		05/17/21 12:25	05/17/21 14:28	1
Fluorene ND	0.087	0.016	ug/L		05/17/21 12:25	05/17/21 14:28	1
Indeno[1,2,3-cd]pyrene ND	0.087	0.021	ug/L		05/17/21 12:25	05/17/21 14:28	1

Eurofins TestAmerica, Spokane

### **Client Sample Results**

Client: BGES, Inc. Project/Site: Othello, WA

Analyte

Pyrene

Surrogate

Analyte

Analyte

PCB-1016

PCB-1221

PCB-1232

PCB-1242

PCB-1248

PCB-1254

PCB-1260

2-Fluorobiphenyl (Surr)

1,2-Dibromoethane (EDB)

Nitrobenzene-d5

p-Terphenyl-d14

Naphthalene

Phenanthrene

#### Client Sample ID: MW1-0511 Date Collected: 05/11/21 12:06 Date Received: 05/13/21 10:00

## Job ID: 590-15130-1

6

#### Lab Sample ID: 590-15130-1 Matrix: Water

Method: 8270E SIM - Semivolatile Organic Compounds (GC/MS SIM) (Continued) MDL Unit **Result Qualifier** RL D Prepared Analyzed Dil Fac 0.087 0.051 ug/L 05/17/21 12:25 05/17/21 14:28 ND 1 ND 0.087 05/17/21 12:25 05/17/21 14:28 0.054 ug/L 1 ND \*1 0.087 0.025 ug/L 05/17/21 12:25 05/17/21 14:28 1 Qualifier Limits Prepared Dil Fac %Recovery Analyzed 73 36 - 120 05/17/21 12:25 05/17/21 14:28 1 29 - 121 05/17/21 12:25 05/17/21 14:28 90 1 100 51 - 121 05/17/21 12:25 05/17/21 14:28 1 Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC) **Result Qualifier** RL MDL Unit D Prepared Analyzed Dil Fac 0.010 ND 0.0025 ug/L 05/25/21 13:24 05/26/21 03:29 1 Method: 8082A - Polychlorinated Biphenyls (PCBs) by Gas Chromatography **Result Qualifier** RL MDL Unit D Prepared Dil Fac Analyzed ND 0.098 0.061 ug/L 05/16/21 16:29 05/17/21 16:50 1 ND 0.098 0.061 ug/L 05/16/21 16:29 05/17/21 16:50 1 ND 0.061 ug/L 0.098 05/16/21 16:29 05/17/21 16:50 1 ND 0.061 ug/L 0.098 05/16/21 16:29 05/17/21 16:50 1 ND 0.098 0.061 ug/L 05/16/21 16:29 05/17/21 16:50 1 ND 0.098 0.061 ug/L 05/16/21 16:29 05/17/21 16:50 1 ND 0.098 0.042 ug/L 05/16/21 16:29 05/17/21 16:50 1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Tetrachloro-m-xylene	57		20 - 120	05/16/21 16:29	05/17/21 16:50	1
DCB Decachlorobiphenyl (Surr)	78		39 - 120	05/16/21 16:29	05/17/21 16:50	1

#### Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics (DRO) (C10-C25)	ND		0.23	0.11	mg/L		05/25/21 14:46	05/25/21 18:22	1
Residual Range Organics (RRO) (C25-C36)	ND		0.38	0.11	mg/L		05/25/21 14:46	05/25/21 18:22	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
o-Terphenyl	79		50 - 150	05/25/21 14:46	05/25/21 18:22	1
n-Triacontane-d62	66		50 - 150	05/25/21 14:46	05/25/21 18:22	1

#### Method: 6020B - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	0.0011	J	0.0020	0.00019	mg/L		05/18/21 16:33	05/19/21 07:04	5
Chromium	0.11		0.0040	0.00087	mg/L		05/18/21 16:33	05/19/21 07:04	5
Lead	0.052		0.0020	0.00020	mg/L		05/18/21 16:33	05/19/21 07:04	5
Nickel	0.14		0.015	0.00063	mg/L		05/18/21 16:33	05/19/21 07:04	5
Zinc	0.34		0.035	0.0046	mg/L		05/18/21 16:33	05/19/21 07:04	5
### Client Sample ID: MW2-0511 Date Collected: 05/11/21 12:19 Date Received: 05/13/21 10:00

lob	ID:	590-15130-
100	ıD.	000-10100-

# Lab Sample ID: 590-15130-2

Matrix: Water

Method: 8260D - Volatile Org	Janic Compounds by GC	/11/15	мпі	Unit	п	Proparad	Analyzad	Dil Eac	5
Allalyte		<b></b>			D	Prepareu			J
1, 1, 1, 2- retrachioroethane	ND	0.30	0.036	ug/L			05/17/21 10:32	1	6
	ND	0.20	0.025	ug/L			05/17/21 10.32	1	O
1, 1, 2, Z- Tetracinoroethane		0.20	0.030	ug/L			05/17/21 10:32		
1,1,2-memoroethana	ND	0.20	0.070	ug/L			05/17/21 10.32	1	
	ND	0.20	0.025	ug/L			05/17/21 10.32	1	
	ND ND	0.20	0.035	ug/L			05/17/21 10.32		8
1, 1-Dichloropropene	ND	0.20	0.030	ug/L			05/17/21 10.32	1	
	ND	0.30	0.15	ug/L			05/17/21 18:32	1	9
1,2,4 Trichlorobonzono		0.20	0.030	ug/L			05/17/21 18:32	· · · · · · · · · · · · · · · · · · ·	
1.2.4 Trimothylbonzono	ND	0.30	0.17	ug/L			05/17/21 10:32	1	
1,2,4- Mineury Denzene	ND	2.0	0.072	ug/L			05/17/21 18:32	1	
1.2 Disblorobonzono		0.30	0.039	ug/L			05/17/21 10:32		
1,2-Dichloroothana	ND	0.30	0.030	ug/L			05/17/21 18:32	1	
1,2-Dichloropropage	ND	0.20	0.043	ug/L			05/17/21 18:32	1	
1,2-Dichloropropane		0.20	0.000	ug/L			05/17/21 10:32		
1,3,5- Mineurybenzene	ND	0.30	0.15	ug/L			05/17/21 18:32	1	
1.3-Dichloropropage	ND	0.30	0.000	ug/L			05/17/21 18:32	1	
1,0-Dichlorobenzene	ND	0.20	0.025	ug/L			05/17/21 18:32		
2 2 Dichloropropane	ND	0.50	0.000	ug/L			05/17/21 18:32	1	
2.Chlorotoluene	ND	0.50	0.000	ug/L			05/17/21 18:32	1	
	ND	0.30	0.12	ug/L			05/17/21 18:32	· · · · · · · · · · · · · · · · · · ·	
	ND	0.50	0.000	ug/L			05/17/21 18:32	1	
Benzene	ND	0.30	0.13	ug/L			05/17/21 18:32	1	
Bromohenzene	ND	0.20	0.000	ug/L			05/17/21 18:32	····· 1	
Bromoform	ND	0.20	0.000	ug/L			05/17/21 18:32	1	
Bromomethane	ND	0.50	0.10	ug/L			05/17/21 18:32	1	
Carbon tetrachloride	ND	0.00	0.002	ug/L			05/17/21 18:32		
Chlorobenzene	ND	0.20	0.020	ug/L			05/17/21 18:32	1	
Chlorobromomethane	ND	0.20	0.025	ua/l			05/17/21 18:32	1	
Chlorodibromomethane	ND	0.20	0.055	ua/l			05/17/21 18:32	· · · · · · · · · 1	
Chloroethane	ND	0.50	0.096	ua/l			05/17/21 18:32	1	
Chloroform	ND	0.20	0.030	ua/l			05/17/21 18:32	1	
Chloromethane	ND	0.50	0.068	ua/L			05/17/21 18:32		
cis-1.3-Dichloropropene	ND	0.20	0.090	ua/L			05/17/21 18:32	1	
Dibromomethane	ND	0.20	0.062	ua/L			05/17/21 18:32	1	
Dichlorobromomethane	ND	0.20	0.060	ua/L			05/17/21 18:32		
Dichlorodifluoromethane	ND	0.40	0.13	ua/L			05/17/21 18:32	1	
Ethylbenzene	ND	0.20	0.030	ua/L			05/17/21 18:32	1	
Ethylene Dibromide	ND	0.10	0.025	ua/L			05/17/21 18:32		
Hexachlorobutadiene	ND	0.50	0.067	ua/L			05/17/21 18:32	1	
Isopropylbenzene	ND	1.0	0.19	ua/L			05/17/21 18:32	1	
Methyl tert-butyl ether	ND	0.30	0.070	ug/L			05/17/21 18:32	1	
Methylene Chloride	ND	5.0	1.2	ug/L			05/17/21 18:32	1	
m-Xylene & p-Xylene	ND	0.50	0.12	ug/L			05/17/21 18:32	1	
Naphthalene	ND	1.0	0.22	ua/L			05/17/21 18:32	· · · · · · · · · · · · 1	
n-Butylbenzene	ND	1.0	0.23	ug/L			05/17/21 18:32	1	
N-Propylbenzene	ND	0.30	0.091	ug/L			05/17/21 18:32	1	
o-Xylene	ND	0.50	0.15	ug/L			05/17/21 18:32		

Analyte

sec-Butylbenzene

### Client Sample ID: MW2-0511 Date Collected: 05/11/21 12:19 Date Received: 05/13/21 10:00

#### Lab Sample ID: 590-15130-2 Matrix: Water

Analyzed

05/17/21 18:32

Matrix: Water

Dil Fac

1

Styrene	ND		1.0	0.19	ug/L		05/17/21 18:32	1
tert-Butylbenzene	ND		0.50	0.26	ug/L		05/17/21 18:32	1
Tetrachloroethene	ND		0.50	0.084	ug/L		05/17/21 18:32	1
Toluene	ND		0.20	0.050	ug/L		05/17/21 18:32	1
trans-1,3-Dichloropropene	ND		0.20	0.092	ug/L		05/17/21 18:32	1
Trichlorofluoromethane	ND		0.50	0.043	ug/L		05/17/21 18:32	1
Vinyl chloride	ND		0.020	0.013	ug/L		05/17/21 18:32	1
Surrogate	%Recovery	Qualifier	Limits			Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	100		80 - 120				05/17/21 18:32	1
4-Bromofluorobenzene (Surr)	100		80 - 120				05/17/21 18:32	1
Dibromofluoromethane (Surr)	106		80 - 120				05/17/21 18:32	1
Toluene-d8 (Surr)	101		80 - 120				05/17/21 18:32	1

RL

1.0

MDL Unit

0.17 ug/L

D

Prepared

#### Method: 8260D - Volatile Organic Compounds by GC/MS - RA

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Result Qualifier

ND

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.20	0.055	ug/L			05/18/21 18:21	1
trans-1,2-Dichloroethene	ND		0.20	0.033	ug/L			05/18/21 18:21	1
Trichloroethene	ND		0.20	0.066	ug/L			05/18/21 18:21	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	98		80 - 120		05/18/21 18:21	1
4-Bromofluorobenzene (Surr)	104		80 - 120		05/18/21 18:21	1
Dibromofluoromethane (Surr)	104		80 - 120		05/18/21 18:21	1
Toluene-d8 (Surr)	99		80 - 120		05/18/21 18:21	1

#### Method: NWTPH-Gx - Northwest - Volatile Petroleum Products (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline	ND		150	70	ug/L			05/22/21 02:11	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	98		68.7 - 141					05/22/21 02:11	1

#### Method: 8270E SIM - Semivolatile Organic Compounds (GC/MS SIM)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1-Methylnaphthalene	ND		0.087	0.022	ug/L		05/17/21 12:25	05/17/21 14:51	1
2-Methylnaphthalene	ND		0.087	0.043	ug/L		05/17/21 12:25	05/17/21 14:51	1
Acenaphthene	ND		0.087	0.021	ug/L		05/17/21 12:25	05/17/21 14:51	1
Acenaphthylene	ND		0.087	0.015	ug/L		05/17/21 12:25	05/17/21 14:51	1
Anthracene	ND		0.087	0.024	ug/L		05/17/21 12:25	05/17/21 14:51	1
Benzo[a]anthracene	ND		0.087	0.012	ug/L		05/17/21 12:25	05/17/21 14:51	1
Benzo[a]pyrene	ND		0.087	0.012	ug/L		05/17/21 12:25	05/17/21 14:51	1
Benzo[b]fluoranthene	ND		0.087	0.024	ug/L		05/17/21 12:25	05/17/21 14:51	1
Benzo[g,h,i]perylene	ND		0.087	0.020	ug/L		05/17/21 12:25	05/17/21 14:51	1
Benzo[k]fluoranthene	ND		0.087	0.015	ug/L		05/17/21 12:25	05/17/21 14:51	1
Chrysene	ND		0.087	0.0097	ug/L		05/17/21 12:25	05/17/21 14:51	1
Dibenz(a,h)anthracene	ND		0.087	0.013	ug/L		05/17/21 12:25	05/17/21 14:51	1
Fluoranthene	0.016	JB	0.087	0.016	ug/L		05/17/21 12:25	05/17/21 14:51	1
Fluorene	0.020	JB	0.087	0.015	ug/L		05/17/21 12:25	05/17/21 14:51	1
Indeno[1,2,3-cd]pyrene	ND		0.087	0.021	ug/L		05/17/21 12:25	05/17/21 14:51	1

Client: BGES, Inc. Project/Site: Othello, WA

Analyte

Pyrene

Surrogate

Analyte

Analyte

PCB-1016

PCB-1221

PCB-1232

PCB-1242

PCB-1248

PCB-1254

PCB-1260

2-Fluorobiphenyl (Surr)

1,2-Dibromoethane (EDB)

Nitrobenzene-d5

p-Terphenyl-d14

Naphthalene

Phenanthrene

### Client Sample ID: MW2-0511 Date Collected: 05/11/21 12:19 Date Received: 05/13/21 10:00

### Job ID: 590-15130-1

### Lab Sample ID: 590-15130-2 Matrix: Water

05/16/21 16:29 05/17/21 17:11

1

Method: 8270E SIM - Semivolatile Organic Compounds (GC/MS SIM) (Continued) MDL Unit **Result Qualifier** RL D Prepared Analyzed Dil Fac 0.087 0.051 ug/L 05/17/21 12:25 05/17/21 14:51 J 1 6 0.087 0.054 ug/L 05/17/21 12:25 05/17/21 14:51 1 \*1 0.087 0.025 ug/L 05/17/21 12:25 05/17/21 14:51 1 Qualifier Limits Prepared Dil Fac Analyzed 36 - 120 05/17/21 12:25 05/17/21 14:51 1 29 - 121 05/17/21 12:25 05/17/21 14:51 1 51 - 121 05/17/21 12:25 05/17/21 14:51 1 Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC) **Result Qualifier** RL MDL Unit D Prepared Analyzed Dil Fac 0.010 0.0025 ug/L 05/25/21 13:24 05/26/21 03:45 1 Method: 8082A - Polychlorinated Biphenyls (PCBs) by Gas Chromatography **Result Qualifier** RL MDL Unit D Prepared Dil Fac Analyzed 0.097 0.061 ug/L 05/16/21 16:29 05/17/21 17:11 1 0.097 0.061 ug/L 05/16/21 16:29 05/17/21 17:11 1 0.061 ug/L 0.097 05/16/21 16:29 05/17/21 17:11 1 0.061 ug/L 0.097 05/16/21 16:29 05/17/21 17:11 1 0.097 0.061 ug/L 05/16/21 16:29 05/17/21 17:11 1 0.097 0.061 ug/L 05/16/21 16:29 05/17/21 17:11 1

Surrogate	%Recovery Qualifier	Limits	Prepared	Analyzed	Dil Fac
Tetrachloro-m-xylene	54	20 - 120	05/16/21 16:29	05/17/21 17:11	1
DCB Decachlorobiphenyl (Surr)	81	39 - 120	05/16/21 16:29	05/17/21 17:11	1

0.097

0.042 ug/L

#### Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

0.086

%Recovery

ND

ND

76

91

84

ND

ND

ND

ND

ND

ND

ND

ND

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics (DRO) (C10-C25)	ND		0.24	0.11	mg/L		05/25/21 14:46	05/25/21 18:43	1
Residual Range Organics (RRO) (C25-C36)	ND		0.39	0.12	mg/L		05/25/21 14:46	05/25/21 18:43	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
o-Terphenyl	77		50 - 150	05/25/21 14:46	05/25/21 18:43	1
n-Triacontane-d62	63		50 - 150	05/25/21 14:46	05/25/21 18:43	1

### Method: 6020B - Metals (ICP/MS) - Total Recoverable

Analyte Re	ult Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium 0.0	14 J	0.0020	0.00019	mg/L		05/18/21 16:33	05/19/21 07:08	5
Chromium 0	.15	0.0040	0.00087	mg/L		05/18/21 16:33	05/19/21 07:08	5
Lead 0.	68	0.0020	0.00020	mg/L		05/18/21 16:33	05/19/21 07:08	5
Nickel (	.18	0.015	0.00063	mg/L		05/18/21 16:33	05/19/21 07:08	5
Zinc	.46	0.035	0.0046	mg/L		05/18/21 16:33	05/19/21 07:08	5

### Client Sample ID: MW3-0511 Date Collected: 05/11/21 14:15 Date Received: 05/13/21 10:00

lob	ID:	590-15130-
100	ıD.	000-10100-

# Lab Sample ID: 590-15130-3

Matrix: Water

5

Analyte	Result Qualifier	RL	MDL	Unit	D	Prepared	Analvzed	Dil Fac	
1.1.1.2-Tetrachloroethane	ND	0.30	0.038	ua/L			05/17/21 18:56	1	
1.1.1-Trichloroethane	ND	0.20	0.025	ua/L			05/17/21 18:56	1	
1,1,2,2-Tetrachloroethane	ND	0.20	0.056	ug/L			05/17/21 18:56	1	
1.1.2-Trichloroethane	ND	0.20	0.070	ua/L			05/17/21 18:56	1	
1.1-Dichloroethane	ND	0.20	0.025	ua/L			05/17/21 18:56	1	
1,1-Dichloroethene	ND	0.20	0.035	ug/L			05/17/21 18:56	1	
1,1-Dichloropropene	ND	0.20	0.036	ug/L			05/17/21 18:56	1	
1,2,3-Trichlorobenzene	ND	0.50	0.15	ug/L			05/17/21 18:56	1	
1,2,3-Trichloropropane	ND	0.20	0.050	ug/L			05/17/21 18:56	1	
1,2,4-Trichlorobenzene	ND	0.50	0.17	ug/L			05/17/21 18:56	1	
1,2,4-Trimethylbenzene	ND	0.30	0.072	ug/L			05/17/21 18:56	1	
1,2-Dibromo-3-Chloropropane	ND	2.0	0.44	ug/L			05/17/21 18:56	1	
1,2-Dichlorobenzene	ND	0.30	0.038	ug/L			05/17/21 18:56	1	
1,2-Dichloroethane	ND	0.20	0.043	ug/L			05/17/21 18:56	1	
1,2-Dichloropropane	ND	0.20	0.060	ug/L			05/17/21 18:56	1	
1,3,5-Trimethylbenzene	ND	0.50	0.15	ug/L			05/17/21 18:56	1	
1,3-Dichlorobenzene	ND	0.30	0.050	ug/L			05/17/21 18:56	1	
1,3-Dichloropropane	ND	0.20	0.025	ug/L			05/17/21 18:56	1	
1,4-Dichlorobenzene	ND	0.30	0.050	ug/L			05/17/21 18:56	1	
2,2-Dichloropropane	ND	0.50	0.060	ug/L			05/17/21 18:56	1	
2-Chlorotoluene	ND	0.50	0.12	ug/L			05/17/21 18:56	1	
1-Chlorotoluene	ND	0.30	0.050	ug/L			05/17/21 18:56	1	
1-Isopropyltoluene	ND	0.50	0.15	ug/L			05/17/21 18:56	1	
Benzene	ND	0.20	0.030	ug/L			05/17/21 18:56	1	
Bromobenzene	ND	0.20	0.038	ug/L			05/17/21 18:56	1	
Bromoform	ND	0.50	0.16	ug/L			05/17/21 18:56	1	
Bromomethane	ND	0.50	0.062	ug/L			05/17/21 18:56	1	
Carbon tetrachloride	ND	0.20	0.025	ug/L			05/17/21 18:56	1	
Chlorobenzene	ND	0.20	0.025	ug/L			05/17/21 18:56	1	
Chlorobromomethane	ND	0.20	0.025	ug/L			05/17/21 18:56	1	
Chlorodibromomethane	ND	0.20	0.055	ug/L			05/17/21 18:56	1	
Chloroethane	ND	0.50	0.096	ug/L			05/17/21 18:56	1	
Chloroform	ND	0.20	0.030	ug/L			05/17/21 18:56	1	
Chloromethane	ND	0.50	0.068	ug/L			05/17/21 18:56	1	
cis-1,3-Dichloropropene	ND	0.20	0.090	ug/L			05/17/21 18:56	1	
Dibromomethane	ND	0.20	0.062	ug/L			05/17/21 18:56	1	
Dichlorobromomethane	ND	0.20	0.060	ug/L			05/17/21 18:56	1	
Dichlorodifluoromethane	ND	0.40	0.13	ug/L			05/17/21 18:56	1	
Ethylbenzene	ND	0.20	0.030	ug/L			05/17/21 18:56	1	
Ethylene Dibromide	ND	0.10	0.025	ug/L			05/17/21 18:56	1	
Hexachlorobutadiene	ND	0.50	0.067	ug/L			05/17/21 18:56	1	
lsopropylbenzene	ND	1.0	0.19	ug/L			05/17/21 18:56	1	
Methyl tert-butyl ether	ND	0.30	0.070	ug/L			05/17/21 18:56	1	
Methylene Chloride	ND	5.0	1.2	ug/L			05/17/21 18:56	1	
m-Xylene & p-Xylene	ND	0.50	0.12	ug/L			05/17/21 18:56	1	
Naphthalene	ND	1.0	0.22	ug/L			05/17/21 18:56	1	
n-Butylbenzene	ND	1.0	0.23	ug/L			05/17/21 18:56	1	
N-Propylbenzene	ND	0.30	0.091	ug/L			05/17/21 18:56	1	
o-Xylene	ND	0.50	0.15	ug/L			05/17/21 18:56	1	

RL

1.0

1.0

0.50

0.50

0.20

0.20

0.50

0.020

Limits

80 - 120

80 - 120

80 - 120

80 - 120

MDL Unit

0.17 ug/L

0.19 ug/L

0.26 ug/L

0.084 ug/L

0.050 ug/L

0.092 ug/L

0.043 ug/L

0.013 ug/L

D

Analyte

Styrene

**Toluene** 

Vinyl chloride

Toluene-d8 (Surr)

Surrogate

sec-Butylbenzene

tert-Butylbenzene

Tetrachloroethene

trans-1,3-Dichloropropene

1,2-Dichloroethane-d4 (Surr)

4-Bromofluorobenzene (Surr)

Dibromofluoromethane (Surr)

Trichlorofluoromethane

### Client Sample ID: MW3-0511 Date Collected: 05/11/21 14:15 Date Received: 05/13/21 10:00

# Lab Sample ID: 590-15130-3

**Matrix: Water** 

Prepared	Analyzed	Dil Fac	5
	05/17/21 18:56	1	_
	05/17/21 18:56	1	6
	05/17/21 18:56	1	
	05/17/21 18:56	1	
	05/17/21 18:56	1	
	05/17/21 18:56	1	2
	05/17/21 18:56	1	
	05/17/21 18:56	1	9
Prepared	Analyzed	Dil Fac	
	05/17/21 18:56	1	
	05/17/21 18:56	1	
	05/17/21 18:56	1	
	05/17/21 18:56	1	

#### Method: 8260D - Volatile Organic Compounds by GC/MS - RA

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

**Result Qualifier** 

ND

ND

ND

ND

0.060 J

ND

ND

ND

%Recovery Qualifier

100

100

103

99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.20	0.055	ug/L			05/18/21 18:46	1
trans-1,2-Dichloroethene	ND		0.20	0.033	ug/L			05/18/21 18:46	1
Trichloroethene	ND		0.20	0.066	ug/L			05/18/21 18:46	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	96		80 - 120		05/18/21 18:46	1
4-Bromofluorobenzene (Surr)	104		80 - 120		05/18/21 18:46	1
Dibromofluoromethane (Surr)	106		80 - 120		05/18/21 18:46	1
Toluene-d8 (Surr)	100		80 - 120		05/18/21 18:46	1

#### Method: NWTPH-Gx - Northwest - Volatile Petroleum Products (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline	ND		150	70	ug/L		•	05/22/21 02:33	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	100		68.7 - 141					05/22/21 02:33	1

#### Method: 8270E SIM - Semivolatile Organic Compounds (GC/MS SIM)

Analyte Result	Qualifier RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1-Methylnaphthalene ND	0.096	0.025	ug/L		05/17/21 12:25	05/17/21 15:15	1
2-Methylnaphthalene ND	0.096	0.047	ug/L		05/17/21 12:25	05/17/21 15:15	1
Acenaphthene ND	0.096	0.023	ug/L		05/17/21 12:25	05/17/21 15:15	1
Acenaphthylene ND	0.096	0.017	ug/L		05/17/21 12:25	05/17/21 15:15	1
Anthracene ND	0.096	0.027	ug/L		05/17/21 12:25	05/17/21 15:15	1
Benzo[a]anthracene ND	0.096	0.013	ug/L		05/17/21 12:25	05/17/21 15:15	1
Benzo[a]pyrene ND	0.096	0.013	ug/L		05/17/21 12:25	05/17/21 15:15	1
Benzo[b]fluoranthene ND	0.096	0.027	ug/L		05/17/21 12:25	05/17/21 15:15	1
Benzo[g,h,i]perylene ND	0.096	0.022	ug/L		05/17/21 12:25	05/17/21 15:15	1
Benzo[k]fluoranthene ND	0.096	0.016	ug/L		05/17/21 12:25	05/17/21 15:15	1
Chrysene ND	0.096	0.011	ug/L		05/17/21 12:25	05/17/21 15:15	1
Dibenz(a,h)anthracene ND	0.096	0.014	ug/L		05/17/21 12:25	05/17/21 15:15	1
Fluoranthene ND	0.096	0.018	ug/L		05/17/21 12:25	05/17/21 15:15	1
Fluorene 0.017	<b>J B</b> 0.096	0.017	ug/L		05/17/21 12:25	05/17/21 15:15	1
Indeno[1,2,3-cd]pyrene ND	0.096	0.023	ug/L		05/17/21 12:25	05/17/21 15:15	1

RL

0.096

0.096

0.096

Limits

36 - 120

29 - 121

51 - 121

RL

0.010

MDL Unit

0.056 ug/L

0.060 ug/L

0.028 ug/L

MDL Unit

0.0025 ug/L

D

D

Prepared

Prepared

Client: BGES, Inc. Project/Site: Othello, WA

Analyte

Pyrene

Surrogate

Analyte

2-Fluorobiphenyl (Surr)

1,2-Dibromoethane (EDB)

Nitrobenzene-d5

p-Terphenyl-d14

Naphthalene

Phenanthrene

### Client Sample ID: MW3-0511 Date Collected: 05/11/21 14:15 Date Received: 05/13/21 10:00

Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

### Job ID: 590-15130-1

### Lab Sample ID: 590-15130-3 **Matrix: Water**

05/17/21 12:25 05/17/21 15:15

05/17/21 12:25 05/17/21 15:15

05/17/21 12:25 05/17/21 15:15

05/17/21 12:25 05/17/21 15:15

05/17/21 12:25 05/17/21 15:15

05/17/21 12:25 05/17/21 15:15

Analyzed

Analyzed

6

Dil Fac

Dil Fac

1

1

1

1

1

1

1

8
9

			9
Prepared	Analyzed	Dil Fac	
05/25/21 13:24	05/26/21 04:01	1	

Mothod: 8082A - Polychlorinated Bin	nhonyle (PCBs) by Gas Chromatography
Method. 0002A - I Orychiolinated Dip	phenyis (robs) by das chi chiatography

ND

Method: 8270E SIM - Semivolatile Organic Compounds (GC/MS SIM) (Continued)

ND

ND

ND \*1

%Recovery Qualifier

129 S1+

**Result Qualifier** 

70

93

**Result Qualifier** 

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	ND		0.11	0.070	ug/L		05/16/21 16:29	05/17/21 17:32	1
PCB-1221	ND		0.11	0.070	ug/L		05/16/21 16:29	05/17/21 17:32	1
PCB-1232	ND		0.11	0.070	ug/L		05/16/21 16:29	05/17/21 17:32	1
PCB-1242	ND		0.11	0.070	ug/L		05/16/21 16:29	05/17/21 17:32	1
PCB-1248	ND		0.11	0.070	ug/L		05/16/21 16:29	05/17/21 17:32	1
PCB-1254	ND		0.11	0.070	ug/L		05/16/21 16:29	05/17/21 17:32	1
PCB-1260	ND		0.11	0.049	ug/L		05/16/21 16:29	05/17/21 17:32	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
Tetrachloro-m-xylene	56		20 - 120				05/16/21 16:29	05/17/21 17:32	1

Tetrachioro-m-xylene	56	20 - 120	05/16/21 16:29 05/17/21 17:32
DCB Decachlorobiphenyl (Surr)	75	39 - 120	05/16/21 16:29 05/17/21 17:32

Method: NWTPH-Dx	- Northwest -	Semi-Volatile	Petroleum	<b>Products</b> (	(GC)
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Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics (DRO) (C10-C25)	0.23	J	0.25	0.11	mg/L		05/25/21 14:46	05/25/21 19:03	1
Residual Range Organics (RRO) (C25-C36)	0.40	J	0.41	0.12	mg/L		05/25/21 14:46	05/25/21 19:03	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
o-Terphenyl	81		50 - 150	05/25/21 14:46	05/25/21 19:03	1
n-Triacontane-d62	74		50 - 150	05/25/21 14:46	05/25/21 19:03	1

#### Method: 6020B - Metals (ICP/MS) - Total Recoverable

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		0.0020	0.00019	mg/L		05/18/21 16:33	05/19/21 06:25	5
Chromium	0.0014	J	0.0040	0.00087	mg/L		05/18/21 16:33	05/19/21 06:25	5
Lead	ND		0.0020	0.00020	mg/L		05/18/21 16:33	05/19/21 06:25	5
Nickel	0.0026	J	0.015	0.00063	mg/L		05/18/21 16:33	05/19/21 06:25	5
Zinc	0.011	J	0.035	0.0046	mg/L		05/18/21 16:33	05/19/21 06:25	5

### Client Sample ID: MW4-0511 Date Collected: 05/11/21 17:16 Date Received: 05/13/21 10:00

lob	١D·	590-15130-
100	ıD.	000-10100-

# Lab Sample ID: 590-15130-4

Matrix: Water

5

6

	ganic Compo	unds bv GC	/MS						
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	ND		3.0	0.38	ug/L		-	05/17/21 19:21	10
1,1,1-Trichloroethane	ND		2.0	0.25	ug/L			05/17/21 19:21	10
1,1,2,2-Tetrachloroethane	ND		2.0	0.56	ug/L			05/17/21 19:21	10
1,1,2-Trichloroethane	ND		2.0	0.70	ug/L			05/17/21 19:21	10
1,1-Dichloroethane	ND		2.0	0.25	ug/L			05/17/21 19:21	10
1,1-Dichloroethene	ND		2.0	0.35	ug/L			05/17/21 19:21	10
1,1-Dichloropropene	ND		2.0	0.36	ug/L			05/17/21 19:21	10
1,2,3-Trichlorobenzene	ND		5.0	1.5	ug/L			05/17/21 19:21	10
1,2,3-Trichloropropane	ND		2.0	0.50	ug/L			05/17/21 19:21	10
1,2,4-Trichlorobenzene	ND		5.0	1.7	ug/L			05/17/21 19:21	10
1,2,4-Trimethylbenzene	ND		3.0	0.72	ug/L			05/17/21 19:21	10
1,2-Dibromo-3-Chloropropane	ND		20	4.4	ug/L			05/17/21 19:21	10
1,2-Dichlorobenzene	ND		3.0	0.38	ug/L			05/17/21 19:21	10
1,2-Dichloroethane	ND		2.0	0.43	ug/L			05/17/21 19:21	10
1,2-Dichloropropane	ND		2.0	0.60	ug/L			05/17/21 19:21	10
1,3,5-Trimethylbenzene	ND		5.0	1.5	ug/L			05/17/21 19:21	10
1,3-Dichlorobenzene	ND		3.0	0.50	ug/L			05/17/21 19:21	10
1,3-Dichloropropane	ND		2.0	0.25	ug/L			05/17/21 19:21	10
1,4-Dichlorobenzene	ND		3.0	0.50	ug/L			05/17/21 19:21	10
2,2-Dichloropropane	ND		5.0	0.60	ug/L			05/17/21 19:21	10
2-Chlorotoluene	ND		5.0	1.2	ug/L			05/17/21 19:21	10
4-Chlorotoluene	ND		3.0	0.50	ug/L			05/17/21 19:21	10
4-Isopropyltoluene	ND		5.0	1.5	ug/L			05/17/21 19:21	10
Benzene	ND		2.0	0.30	ug/L			05/17/21 19:21	10
Bromobenzene	ND		2.0	0.38	ug/L			05/17/21 19:21	10
Bromoform	ND		5.0	1.6	ug/L			05/17/21 19:21	10
Bromomethane	ND		5.0	0.62	ug/L			05/17/21 19:21	10
Carbon tetrachloride	ND		2.0	0.25	ug/L			05/17/21 19:21	10
Chlorobenzene	ND		2.0	0.25	ug/L			05/17/21 19:21	10
Chlorobromomethane	ND		2.0	0.25	ug/L			05/17/21 19:21	10
Chlorodibromomethane	ND		2.0	0.55	ug/L			05/17/21 19:21	10
Chloroethane	ND		5.0	0.96	ug/L			05/17/21 19:21	10
Chloroform	ND		2.0	0.30	ug/L			05/17/21 19:21	10
Chloromethane	ND		5.0	0.68	ug/L			05/17/21 19:21	10
cis-1,3-Dichloropropene	ND		2.0	0.90	ug/L			05/17/21 19:21	10
Dibromomethane	ND		2.0	0.62	ug/L			05/17/21 19:21	10
Dichlorobromomethane	ND		2.0	0.60	ug/L			05/17/21 19:21	10
Dichlorodifluoromethane	ND		4.0	1.3	ug/L			05/17/21 19:21	10
Ethylbenzene	ND		2.0	0.30	ug/L			05/17/21 19:21	10
Ethylene Dibromide	ND		1.0	0.25	ug/L			05/17/21 19:21	10
Hexachlorobutadiene	ND		5.0	0.67	ug/L			05/17/21 19:21	10
Isopropylbenzene	ND		10	1.9	ug/L			05/17/21 19:21	10
Methyl tert-butyl ether	ND		3.0	0.70	ug/L			05/17/21 19:21	10
Methylene Chloride	ND		50	12	ug/L			05/17/21 19:21	10
m-Xylene & p-Xylene	ND		5.0	1.2	ug/L			05/17/21 19:21	10
Naphthalene	ND		10	2.2	ug/L			05/17/21 19:21	10
n-Butylbenzene	ND		10	2.3	ug/L			05/17/21 19:21	10
N-Propylbenzene	ND		3.0	0.91	ug/L			05/17/21 19:21	10
o-Xylene	ND		5.0	1.5	ug/L			05/17/21 19:21	10

Toluene-d8 (Surr)

#### Client Sample ID: MW4-0511 Date Collected: 05/11/21 17:16 Date Received: 05/13/21 10:00

# Lab Sample ID: 590-15130-4

05/17/21 19:21

Matrix: Water

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
sec-Butylbenzene	ND		10	1.7	ug/L			05/17/21 19:21	10
Styrene	ND		10	1.9	ug/L			05/17/21 19:21	10
tert-Butylbenzene	ND		5.0	2.6	ug/L			05/17/21 19:21	10
Tetrachloroethene	ND		5.0	0.84	ug/L			05/17/21 19:21	10
Toluene	ND		2.0	0.50	ug/L			05/17/21 19:21	10
trans-1,2-Dichloroethene	ND		2.0	0.33	ug/L			05/17/21 19:21	10
trans-1,3-Dichloropropene	ND		2.0	0.92	ug/L			05/17/21 19:21	10
Trichlorofluoromethane	ND		5.0	0.43	ug/L			05/17/21 19:21	10
Vinyl chloride	ND		0.20	0.13	ug/L			05/17/21 19:21	10
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	102		80 - 120					05/17/21 19:21	10
4-Bromofluorobenzene (Surr)	100		80 - 120					05/17/21 19:21	10
Dibromofluoromethane (Surr)	103		80 - 120					05/17/21 19:21	10

#### Method: 8260D - Volatile Organic Compounds by GC/MS - RA

99

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		2.0	0.55	ug/L			05/18/21 19:11	10
Trichloroethene	ND		2.0	0.66	ug/L			05/18/21 19:11	10
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	97		80 - 120					05/18/21 19:11	10
4-Bromofluorobenzene (Surr)	104		80 - 120					05/18/21 19:11	10
Dibromofluoromethane (Surr)	103		80 - 120					05/18/21 19:11	10
Toluene-d8 (Surr)	99		80 - 120					05/18/21 19:11	10

80 - 120

#### Method: NWTPH-Gx - Northwest - Volatile Petroleum Products (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline	ND		150	70	ug/L			05/22/21 03:15	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	103		68.7 - 141					05/22/21 03:15	1

#### Method: 8270E SIM - Semivolatile Organic Compounds (GC/MS SIM)

Analyte Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1-Methylnaphthalene 0.035	J	0.097	0.025	ug/L		05/17/21 12:25	05/17/21 15:38	1
2-Methylnaphthalene 0.064	J	0.097	0.047	ug/L		05/17/21 12:25	05/17/21 15:38	1
Acenaphthene ND		0.097	0.024	ug/L		05/17/21 12:25	05/17/21 15:38	1
Acenaphthylene 0.024	J	0.097	0.017	ug/L		05/17/21 12:25	05/17/21 15:38	1
Anthracene ND		0.097	0.027	ug/L		05/17/21 12:25	05/17/21 15:38	1
Benzo[a]anthracene ND		0.097	0.013	ug/L		05/17/21 12:25	05/17/21 15:38	1
Benzo[a]pyrene ND		0.097	0.013	ug/L		05/17/21 12:25	05/17/21 15:38	1
Benzo[b]fluoranthene ND		0.097	0.027	ug/L		05/17/21 12:25	05/17/21 15:38	1
Benzo[g,h,i]perylene ND		0.097	0.023	ug/L		05/17/21 12:25	05/17/21 15:38	1
Benzo[k]fluoranthene ND		0.097	0.016	ug/L		05/17/21 12:25	05/17/21 15:38	1
Chrysene ND		0.097	0.011	ug/L		05/17/21 12:25	05/17/21 15:38	1
Dibenz(a,h)anthracene ND		0.097	0.014	ug/L		05/17/21 12:25	05/17/21 15:38	1
Fluoranthene 0.021	JB	0.097	0.018	ug/L		05/17/21 12:25	05/17/21 15:38	1
Fluorene 0.025	JB	0.097	0.017	ug/L		05/17/21 12:25	05/17/21 15:38	1
Indeno[1,2,3-cd]pyrene ND		0.097	0.024	ug/L		05/17/21 12:25	05/17/21 15:38	1

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5

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Client: BGES, Inc. Project/Site: Othello, WA

Zinc

### Client Sample ID: MW4-0511 Date Collected: 05/11/21 17:16 Date Received: 05/13/21 10:00

### Job ID: 590-15130-1

#### Lab Sample ID: 590-15130-4 Matrix: Water

Matrix: Water

Method: 8270E SIM - Semivol	atile Organi	c Compou	nds (GC/MS	SIM) (Co	ontinued	)			
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Naphthalene	0.076	J	0.097	0.057	ug/L		05/17/21 12:25	05/17/21 15:38	1
Phenanthrene	ND		0.097	0.060	ug/L		05/17/21 12:25	05/17/21 15:38	1
Pyrene	ND	*1	0.097	0.028	ug/L		05/17/21 12:25	05/17/21 15:38	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
2-Fluorobiphenyl (Surr)	71		36 - 120				05/17/21 12:25	05/17/21 15:38	1
Nitrobenzene-d5	55		29 - 121				05/17/21 12:25	05/17/21 15:38	1
p-Terphenyl-d14	99		51 - 121				05/17/21 12:25	05/17/21 15:38	1
- Method: 8011 - EDB, DBCP, a	nd 1,2,3-TC	P (GC)							
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.010	0.0025	ug/L		05/25/21 13:24	05/26/21 04:18	1
Method: 8082A - Polychlorina	ated Biphen	/Is (PCBs)	by Gas Chr	omatoar	aphy				
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	ND		0.10	0.065	ug/L		05/16/21 16:29	05/17/21 17:52	1
PCB-1221	ND		0.10	0.065	ug/L		05/16/21 16:29	05/17/21 17:52	1
PCB-1232	ND		0.10	0.065	ug/L		05/16/21 16:29	05/17/21 17:52	1
PCB-1242	ND		0.10	0.065	ug/L		05/16/21 16:29	05/17/21 17:52	1
PCB-1248	ND		0.10	0.065	ug/L		05/16/21 16:29	05/17/21 17:52	1
PCB-1254	ND		0.10	0.065	ug/L		05/16/21 16:29	05/17/21 17:52	1
PCB-1260	ND		0.10	0.045	ug/L		05/16/21 16:29	05/17/21 17:52	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
Tetrachloro-m-xylene	44		20 - 120				05/16/21 16:29	05/17/21 17:52	1
DCB Decachlorobiphenyl (Surr)	74		39 - 120				05/16/21 16:29	05/17/21 17:52	1
- Method: NWTPH-Dx - Northw	est - Semi-V	olatile Pet	roleum Prod	ducts (GC	C)				
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics (DRO)	0.31		0.26	0.12	mg/L		05/25/21 14:46	05/25/21 19:24	1
Residual Range Organics (RRO) (C25-C36)	0.31	J	0.43	0.13	mg/L		05/25/21 14:46	05/25/21 19:24	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
o-Terphenyl	66		50 - 150				05/25/21 14:46	05/25/21 19:24	1
n-Triacontane-d62	58		50 - 150				05/25/21 14:46	05/25/21 19:24	1
Method: 6020B - Metals (ICP/	MS) - Total F	Recoverab	le						
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		0.0020	0.00019	mg/L		05/18/21 16:33	05/19/21 07:11	5
<b>A I</b>	0 0000		0.0040	0 00007			05/40/04 40:00	05/40/04 07:44	-
Chromium	0.0060		0.0040	0.00087	mg/L		05/18/21 16:33	05/19/21 07:11	5
Chromium Lead	0.0080	J	0.0040	0.00087	mg/L		05/18/21 16:33	05/19/21 07:11	5 5

05/18/21 16:33 05/19/21 07:11

0.035

0.016 J

0.0046 mg/L

### **Client Sample ID: Trip Blank** Date Collected: 05/11/21 00:00 Date Received: 05/13/21 10:00

Job	ID:	590-1	15130	-1

# Lab Sample ID: 590-15130-5

Matrix: Water

Method: 8260D - Volatile Or	rganic Compo	unds by GC	/MS							
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac	5
1,1,1,2-Tetrachloroethane	ND		0.30	0.038	ug/L			05/17/21 19:46	1	
1,1,1-Trichloroethane	ND		0.20	0.025	ug/L			05/17/21 19:46	1	6
1,1,2,2-Tetrachloroethane	ND		0.20	0.056	ug/L			05/17/21 19:46	1	
1,1,2-Trichloroethane	ND		0.20	0.070	ug/L			05/17/21 19:46	1	
1,1-Dichloroethane	ND		0.20	0.025	ug/L			05/17/21 19:46	1	
1,1-Dichloroethene	ND		0.20	0.035	ug/L			05/17/21 19:46	1	8
1,1-Dichloropropene	ND		0.20	0.036	ug/L			05/17/21 19:46	1	
1,2,3-Trichlorobenzene	ND		0.50	0.15	ug/L			05/17/21 19:46	1	0
1,2,3-Trichloropropane	ND		0.20	0.050	ug/L			05/17/21 19:46	1	3
1,2,4-Trichlorobenzene	ND		0.50	0.17	ug/L			05/17/21 19:46	1	
1,2,4-Trimethylbenzene	ND		0.30	0.072	ug/L			05/17/21 19:46	1	
1,2-Dibromo-3-Chloropropane	ND		2.0	0.44	ug/L			05/17/21 19:46	1	
1,2-Dichlorobenzene	ND		0.30	0.038	ug/L			05/17/21 19:46	1	
1,2-Dichloroethane	ND		0.20	0.043	ug/L			05/17/21 19:46	1	
1,2-Dichloropropane	ND		0.20	0.060	ug/L			05/17/21 19:46	1	
1,3,5-Trimethylbenzene	ND		0.50	0.15	ug/L			05/17/21 19:46	1	
1,3-Dichlorobenzene	ND		0.30	0.050	ug/L			05/17/21 19:46	1	
1,3-Dichloropropane	ND		0.20	0.025	ug/L			05/17/21 19:46	1	
1,4-Dichlorobenzene	ND		0.30	0.050	ug/L			05/17/21 19:46	1	
2,2-Dichloropropane	ND		0.50	0.060	ug/L			05/17/21 19:46	1	
2-Chlorotoluene	ND		0.50	0.12	ug/L			05/17/21 19:46	1	
4-Chlorotoluene	ND		0.30	0.050	ug/L			05/17/21 19:46	1	
4-Isopropyltoluene	ND		0.50	0.15	ug/L			05/17/21 19:46	1	
Benzene	ND		0.20	0.030	ug/L			05/17/21 19:46	1	
Bromobenzene	ND		0.20	0.038	ug/L			05/17/21 19:46	1	
Bromoform	ND		0.50	0.16	ug/L			05/17/21 19:46	1	
Bromomethane	ND		0.50	0.062	ug/L			05/17/21 19:46	1	
Carbon tetrachloride	ND		0.20	0.025	ug/L			05/17/21 19:46	1	
Chlorobenzene	ND		0.20	0.025	ug/L			05/17/21 19:46	1	
Chlorobromomethane	ND		0.20	0.025	ug/L			05/17/21 19:46	1	
Chlorodibromomethane	ND		0.20	0.055	ug/L			05/17/21 19:46	1	
Chloroethane	ND		0.50	0.096	ug/L			05/17/21 19:46	1	
Chloroform	ND		0.20	0.030	ug/L			05/17/21 19:46	1	
Chloromethane	ND		0.50	0.068	ug/L			05/17/21 19:46	1	
cis-1,3-Dichloropropene	ND		0.20	0.090	ug/L			05/17/21 19:46	1	
Dibromomethane	ND		0.20	0.062	ug/L			05/17/21 19:46	1	
Dichlorobromomethane	ND		0.20	0.060	ug/L			05/17/21 19:46	1	
Dichlorodifluoromethane	ND		0.40	0.13	ug/L			05/17/21 19:46	1	
Ethylbenzene	ND		0.20	0.030	ug/L			05/17/21 19:46	1	
Ethylene Dibromide	ND		0.10	0.025	ug/L			05/17/21 19:46	1	
Hexachlorobutadiene	ND		0.50	0.067	ug/L			05/17/21 19:46	1	
Isopropylbenzene	ND		1.0	0.19	ug/L			05/17/21 19:46	1	
Methyl tert-butyl ether	ND		0.30	0.070	ug/L			05/17/21 19:46	1	
Methylene Chloride	3.0	J	5.0	1.2	ug/L			05/17/21 19:46	1	
m-Xylene & p-Xylene	ND		0.50	0.12	ug/L			05/17/21 19:46	1	
Naphthalene	ND		1.0	0.22	ug/L			05/17/21 19:46	1	
n-Butylbenzene	ND		1.0	0.23	ug/L			05/17/21 19:46	1	
N-Propylbenzene	ND		0.30	0.091	ug/L			05/17/21 19:46	1	
o-Xylene	ND		0.50	0.15	ug/L			05/17/21 19:46	1	

# **Client Sample ID: Trip Blank** Date Collected: 05/11/21 00:00 Date Received: 05/13/21 10:00

# Lab Sample ID: 590-15130-5

Matrix: Water

liaiyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
ec-Butylbenzene	ND		1.0	0.17	ug/L			05/17/21 19:46	1
Styrene	ND		1.0	0.19	ug/L			05/17/21 19:46	1
ert-Butylbenzene	ND		0.50	0.26	ug/L			05/17/21 19:46	1
Tetrachloroethene	ND		0.50	0.084	ug/L			05/17/21 19:46	1
Toluene	ND		0.20	0.050	ug/L			05/17/21 19:46	1
rans-1,2-Dichloroethene	ND		0.20	0.033	ug/L			05/17/21 19:46	1
rans-1,3-Dichloropropene	ND		0.20	0.092	ug/L			05/17/21 19:46	1
Trichlorofluoromethane	ND		0.50	0.043	ug/L			05/17/21 19:46	1
Vinyl chloride	ND		0.020	0.013	ug/L			05/17/21 19:46	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
,2-Dichloroethane-d4 (Surr)	103		80 - 120			-		05/17/21 19:46	1
4-Bromofluorobenzene (Surr)	100		80 - 120					05/17/21 19:46	1
Dibromofluoromethane (Surr)	103		80 - 120					05/17/21 19:46	1
Toluene-d8 (Surr)	100		80 - 120					05/17/21 19:46	1
Method: 8260D - Volatile O	rganic Compo	unds bv G	C/MS - RA						
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
sis-1,2-Dichloroethene	ND		0.20	0.055	ug/L			05/18/21 19:36	1
Frichloroethene	ND		0.20	0.066	ug/L			05/18/21 19:36	1
		Qualifier	l imits				Prepared	Analyzed	Dil Fac
Surrogate	%Recovery		Emmeo			-		05/18/21 19:36	1
Surrogate 1,2-Dichloroethane-d4 (Surr)	<u>%Recovery</u> 99		80 - 120						
S <b>urrogate</b> ,2-Dichloroethane-d4 (Surr) I-Bromofluorobenzene (Surr)	<u>%Recovery</u> 		80 - 120 80 - 120					05/18/21 19:36	1
Surrogate 1,2-Dichloroethane-d4 (Surr) 4-Bromofluorobenzene (Surr) Dibromofluoromethane (Surr)	%Recovery 99 103 103		80 - 120 80 - 120 80 - 120 80 - 120					05/18/21 19:36 05/18/21 19:36	1 1
Surrogate 1,2-Dichloroethane-d4 (Surr) 4-Bromofluorobenzene (Surr) Dibromofluoromethane (Surr) Toluene-d8 (Surr)	<u>%Recovery</u> 99 103 103 99		80 - 120 80 - 120 80 - 120 80 - 120					05/18/21 19:36 05/18/21 19:36 05/18/21 19:36	1 1 1
Surrogate 1,2-Dichloroethane-d4 (Surr) 4-Bromofluorobenzene (Surr) Dibromofluoromethane (Surr) Toluene-d8 (Surr) Method: NWTPH-Gx - NortI		Petroleu	80 - 120 80 - 120 80 - 120 80 - 120 80 - 120	GC/MS)				05/18/21 19:36 05/18/21 19:36 05/18/21 19:36	1 1 1
Surrogate 1,2-Dichloroethane-d4 (Surr) 4-Bromofluorobenzene (Surr) Dibromofluoromethane (Surr) Toluene-d8 (Surr) Method: NWTPH-Gx - NortI Analyte		Petroleu Qualifier	80 - 120 80 - 120 80 - 120 80 - 120 80 - 120 m Products ( RL	GC/MS) MDL	Unit	D	Prepared	05/18/21 19:36 05/18/21 19:36 05/18/21 19:36 Analyzed	1 1 1 Dil Fac
Surrogate 1,2-Dichloroethane-d4 (Surr) 4-Bromofluorobenzene (Surr) Dibromofluoromethane (Surr) Toluene-d8 (Surr) Method: NWTPH-Gx - NortI Analyte Gasoline	%Recovery           99           103           103           99           103           99           103           99           103           99           103           99           103           99           104           Result           ND	Petroleu Qualifier	80 - 120 80 - 120 80 - 120 80 - 120 <b>m Products (</b> <u>RL</u> 150	GC/MS) MDL 70	Unit ug/L	<u> </u>	Prepared	05/18/21 19:36 05/18/21 19:36 05/18/21 19:36 <b>Analyzed</b> 05/22/21 03:36	1 1 1 <b>Dil Fac</b> 1
Surrogate 1,2-Dichloroethane-d4 (Surr) 4-Bromofluorobenzene (Surr) Dibromofluoromethane (Surr) Toluene-d8 (Surr) Method: NWTPH-Gx - NortI Analyte Gasoline Surrogate		Qualifier	80 - 120 80 - 120 80 - 120 80 - 120 m Products ( <u>RL</u> 150 <i>Limits</i>	GC/MS) MDL 70	Unit ug/L	<u> </u>	Prepared	05/18/21 19:36 05/18/21 19:36 05/18/21 19:36 <b>Analyzed</b> 05/22/21 03:36 <b>Analyzed</b>	1 1 Dil Fac 1 Dil Fac

Date Collected: 05/11/21 00:00 Date Received: 05/13/21 10:00

Method: 8011 - EDB, DBCP,	and 1,2,3-TCP (GC)							
Analyte	Result Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND	0.010	0.0025	ug/L		05/25/21 13:24	05/26/21 04:34	1
Client Sample ID: SB1-1-	0511				L	ab Sample	D: 590-15	130-7
Date Collected: 05/11/21 09:19	)					-	Matrix	: Solid

### Date Received: 05/13/21 10:00

Method: 8260D - Volatile Organic Compounds by GC/MS										
Analyte	Result Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac		
1,1,1,2-Tetrachloroethane	ND	0.14	0.026	mg/Kg	— — ¤	05/24/21 17:52	05/24/21 22:34	1		
1,1,1-Trichloroethane	ND	0.14	0.024	mg/Kg	¢	05/24/21 17:52	05/24/21 22:34	1		
1,1,2,2-Tetrachloroethane	ND	0.14	0.040	mg/Kg	¢	05/24/21 17:52	05/24/21 22:34	1		
1,1,2-Trichloroethane	ND	0.14	0.048	mg/Kg	₽	05/24/21 17:52	05/24/21 22:34	1		

Eurofins TestAmerica, Spokane

Percent Solids: 79.4

### Client Sample ID: SB1-1-0511 Date Collected: 05/11/21 09:19 Date Received: 05/13/21 10:00

# Lab Sample ID: 590-15130-7

Matrix: Solid Percent Solids: 79.4

Method: 8260D - Volatile Org	anic Compounds by GC	/MS (Contir	nued)		_				E
Analyte	Result Qualifier		MDL	Unit	D	Prepared	Analyzed	Dil Fac	J
1,1-Dichloroethane	ND	0.14	0.036	mg/Kg	¢	05/24/21 17:52	05/24/21 22:34	1	
1,1-Dichloroethene	ND	0.14	0.047	mg/Kg	¢	05/24/21 17:52	05/24/21 22:34	1	6
1,1-Dichloropropene	ND	0.14	0.024	mg/Kg	¢	05/24/21 17:52	05/24/21 22:34	1	
1,2,3-Trichlorobenzene	ND	0.14	0.046	mg/Kg	¢	05/24/21 17:52	05/24/21 22:34	1	
1,2,3-Trichloropropane	ND	0.27	0.050	mg/Kg	₽	05/24/21 17:52	05/24/21 22:34	1	
1,2,4-Trichlorobenzene	ND	0.14	0.025	mg/Kg	¢	05/24/21 17:52	05/24/21 22:34	1	8
1,2,4-Trimethylbenzene	ND	0.14	0.032	mg/Kg	¢	05/24/21 17:52	05/24/21 22:34	1	
1,2-Dibromo-3-Chloropropane	ND	0.69	0.082	mg/Kg	☆	05/24/21 17:52	05/24/21 22:34	1	Q
1,2-Dichlorobenzene	ND	0.14	0.032	mg/Kg	₽	05/24/21 17:52	05/24/21 22:34	1	
1,2-Dichloroethane	ND	0.14	0.021	mg/Kg	₽	05/24/21 17:52	05/24/21 22:34	1	
1,2-Dichloropropane	ND	0.16	0.042	mg/Kg	¢	05/24/21 17:52	05/24/21 22:34	1	
1,3,5-Trimethylbenzene	ND	0.14	0.044	mg/Kg	₽	05/24/21 17:52	05/24/21 22:34	1	
1,3-Dichlorobenzene	ND	0.14	0.017	mg/Kg	₽	05/24/21 17:52	05/24/21 22:34	1	
1,3-Dichloropropane	ND	0.14	0.041	mg/Kg	¢	05/24/21 17:52	05/24/21 22:34	1	
1,4-Dichlorobenzene	ND	0.14	0.028	mg/Kg	¢	05/24/21 17:52	05/24/21 22:34	1	
2,2-Dichloropropane	ND	0.14	0.033	mg/Kg	¢	05/24/21 17:52	05/24/21 22:34	1	
2-Chlorotoluene	ND	0.14	0.022	mg/Kg	¢	05/24/21 17:52	05/24/21 22:34	1	
4-Chlorotoluene	ND	0.14	0.012	mg/Kg	¢	05/24/21 17:52	05/24/21 22:34	1	
4-Isopropyltoluene	ND	0.14	0.028	mg/Kg	☆	05/24/21 17:52	05/24/21 22:34	1	
Benzene	ND	0.027	0.014	mg/Kg	☆	05/24/21 17:52	05/24/21 22:34	1	
Bromobenzene	ND	0.14	0.031	mg/Kg		05/24/21 17:52	05/24/21 22:34	1	
Bromoform	ND	0.27	0.026	ma/Ka	¢	05/24/21 17:52	05/24/21 22:34	1	
Bromomethane	ND	0.69	0.045	ma/Ka	¢	05/24/21 17:52	05/24/21 22:34	1	
Carbon tetrachloride	ND	0.14	0.015	ma/Ka		05/24/21 17:52	05/24/21 22:34	1	
Chlorobenzene	ND	0.14	0.028	ma/Ka	÷	05/24/21 17:52	05/24/21 22:34	1	
Chlorobromomethane	ND	0 14	0.055	ma/Ka	÷	05/24/21 17:52	05/24/21 22:34	1	
Chlorodibromomethane	ND	0.27	0.022	ma/Ka		05/24/21 17:52	05/24/21 22:34	1	
Chloroethane	ND	0.27	0.077	ma/Ka	÷	05/24/21 17:52	05/24/21 22:34	1	
Chloroform	ND	0.14	0.032	ma/Ka	-0-	05/24/21 17:52	05/24/21 22:34	1	
Chloromethane	ND	0.69	0.057	ma/Ka		05/24/21 17:52	05/24/21 22:34		
cis-1 2-Dichloroethene	ND	0.14	0.029	ma/Ka		05/24/21 17:52	05/24/21 22:34	1	
cis-1,3-Dichloropropene	ND	0.14	0.028	ma/Ka	÷.	05/24/21 17:52	05/24/21 22:34	1	
Dibromomethane	ND	0.14	0.020	ma/Ka		05/24/21 17:52	05/24/21 22:34		
Dichlorobromomethane	ND	0.14	0.085	ma/Ka	т 	05/24/21 17:52	05/24/21 22:34	1	
Dichlorodifluoromethane	ND	0.14	0.039	ma/Ka	т ň	05/24/21 17:52	05/24/21 22:34	1	
Ethylbenzene	ND	0.14	0.022	ma/Ka	. ۳ ۲۴	05/24/21 17:52	05/24/21 22:34		
Ethylene Dibromide	ND	0.14	0.022	mg/Kg	*	05/24/21 17:52	05/24/21 22:34	1	
Hexachlorobutadiene	ND	0.14	0.040	mg/Kg	~~ .^.	05/24/21 17:52	05/24/21 22:34	1	
Isopropylbenzene		0.14	0.020	mg/Kg		05/24/21 17:52	05/24/21 22:34		
Methyl tert-butyl ether	ND	0.14	0.042	mg/Kg	ж ж	05/24/21 17:52	05/24/21 22:34	1	
Methylene Chloride	ND	0.005	0.041	mg/Kg	*	05/24/21 17:52	05/24/21 22:34	1	
m-Xylene & n-Xylene		0.40	0.27	mg/Kg	بر 	05/24/21 17:52	05/24/21 22:34	1	
Nanhthalono	0.050	0.00	0.009	mg/Kg	بد بر	05/24/21 17.52	05/24/21 22.04	1	
n-Butylbenzene		0.27	0.030	mg/Kg	ᆉ	05/24/21 17.52	05/24/21 22.34	1	
		0.14	0.030	mg/Kg	<del>بر</del>	05/24/21 17.52	05/24/21 22.34	I	
		0.14	0.030	mg/Kg	<del>بر</del> ب	05/24/21 17.02	05/24/21 22.34	1	
o-Ayidhe		0.27	0.032	mg/Kg	よ ~	05/24/21 17:02	05/24/21 22:34	1	
Sec-Dulyiperizerie		0.14	0.020	mg/Kg	¢	05/24/21 17:52	05/24/21 22:34	۲ ۲	
		0.14	0.032	ing/Kg	₽ 	05/24/21 17:52	05/24/21 22:34	1	
lei i-duiyidei izene	NU	0.14	0.027	mg/Kg	÷.	00/24/21 17:52	03/24/21 22:34	1	

### Client Sample ID: SB1-1-0511 Date Collected: 05/11/21 09:19 Date Received: 05/13/21 10:00

### Lab Sample ID: 590-15130-7 Matrix: Solid

Percent Solids: 79.4

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Method: 8260D - Volatile O	rganic Compo	unds by C	C/MS (Contir	nued)		-	Durand	A	D'I
		Qualifier	<b>RL</b>			<u> </u>	Prepared	Analyzed	
	ND		0.055	0.024	mg/Kg	÷	05/24/21 17:52	05/24/21 22:34	1
Ioluene	ND		0.14	0.018	mg/Kg	-Q-	05/24/21 17:52	05/24/21 22:34	1
trans-1,2-Dichloroethene	ND		0.14	0.031	mg/Kg	-Q-	05/24/21 17:52	05/24/21 22:34	1
trans-1,3-Dichloropropene	ND		0.14	0.036	mg/Kg	<u>.</u>	05/24/21 17:52	05/24/21 22:34	1
Irichloroethene	ND		0.034	0.010	mg/Kg	¢	05/24/21 17:52	05/24/21 22:34	1
Trichlorofluoromethane	ND		0.27	0.045	mg/Kg	.☆	05/24/21 17:52	05/24/21 22:34	1
Vinyl chloride	ND		0.082	0.028	mg/Kg	¢	05/24/21 17:52	05/24/21 22:34	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	100		75 - 129				05/24/21 17:52	05/24/21 22:34	1
4-Bromofluorobenzene (Surr)	101		76 - 122				05/24/21 17:52	05/24/21 22:34	1
Dibromofluoromethane (Surr)	98		80 - 120				05/24/21 17:52	05/24/21 22:34	1
Toluene-d8 (Surr)	99		80 - 120				05/24/21 17:52	05/24/21 22:34	1
- Method: NWTPH-Gx - North	hwest - Volatile	Petroleu	m Products (						
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analvzed	Dil Fac
Gasoline	ND		6.9	2.5	mg/Kg	 ¢	05/24/21 17:52	05/24/21 22:34	1
•		o					_ ,		
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	101		41.5 - 162				05/24/21 17:52	05/24/21 22:34	1
- Mathadi 8270E SIM Samiji	volatila Organi	o Compo							
Method: 62/UE SIW - Seriin		Ouglifier			Unit	<b>_</b>	Bronorod	Applyzod	
		Quaimer	- <u> </u>			— <del>—</del>	05/24/21 11:22	05/24/21 21:00	
			12	2.0	ug/Kg	ېد بر	05/24/21 11:33	05/24/21 21:00	1
			12	2.9	ug/Kg	ېر بې	05/24/21 11:33	05/24/21 21:00	1
Acenaphthylana			12	J.1 4.1	ug/Kg	ۍد س	05/24/21 11:33	05/24/21 21:00	
Anthropono			12	4.1	ug/rtg	ۍد س	05/24/21 11:33	05/24/21 21:00	1
Antiliacene			12	2.5	ug/Kg	भू भू	05/24/21 11:33	05/24/21 21:00	1
Benzolajantniacene			12	Z.1	ug/r.g	<del>بر</del>	05/24/21 11:33	05/24/21 21.00	
	ND		12	5.3	ug/Kg	-\$? 	05/24/21 11:33	05/24/21 21:00	1
	ND		12	4.4	ug/Kg	-\$? 	05/24/21 11:33	05/24/21 21:00	1
Benzolg,n,ijperviene			12	2.9	ug/r.g	÷	05/24/21 11:33	05/24/21 21.00	·····
Benzolkjiluorantnene	ND		12	3.1	ug/Kg	-Q:	05/24/21 11:33	05/24/21 21:00	1
	ND		12	1.9	ug/Kg	-Q:	05/24/21 11:33	05/24/21 21:00	1
	ND		12	3.5	ug/Kg	÷Q:	05/24/21 11:33	05/24/21 21:00	
Fluoranthene	ND		12	3.1	ug/Kg	-Q-	05/24/21 11:33	05/24/21 21:00	1
Fluorene	ND		12	2.8	ug/Kg	-Q-	05/24/21 11:33	05/24/21 21:00	1
Indeno[1,2,3-cd]pyrene	ND		12	3.7	ug/Kg		05/24/21 11:33	05/24/21 21:00	1
Naphthalene	ND		12	2.7	ug/Kg		05/24/21 11:33	05/24/21 21:00	1
Phenanthrene	ND		12	4.5	ug/Kg	÷.	05/24/21 11:33	05/24/21 21:00	1
Pyrene	ND		12	4.7	ug/Kg	¢	05/24/21 11:33	05/24/21 21:00	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
2-Fluorobiphenyl (Surr)	81		47 - 120				05/24/21 11:33	05/24/21 21:00	1
Nitrobenzene-d5	72		33 - 120				05/24/21 11:33	05/24/21 21:00	1
p-Terphenyl-d14	105		74 - 120				05/24/21 11:33	05/24/21 21:00	1
- Method: 8011 - EDB_DBCP	and 1.2.3-TC	P (GC)							
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.095	0.042	ug/Kg	— <u> </u>	05/25/21 11:10	05/25/21 22:00	1
/					0.0				

1,2-Dichlorobenzene

1,2-Dichloroethane

### Client Sample ID: SB1-1-0511 Date Collected: 05/11/21 09:19 Date Received: 05/13/21 10:00

### Lab Sample ID: 590-15130-7 Matrix: Solid

Percent Solids: 79.4

5 6 7

Analyte	Result	Qualifier	RI	MDI	Unit	р	Prepared	Analyzed	Dil Fa
PCB-1016		quamer	12	2.6		— <u>–</u>	05/25/21 10:45	05/25/21 14:49	
PCB-1221			12	2.0	ua/Ka	ň	05/25/21 10:45	05/25/21 14:49	
PCB-1232			12	2.0	ua/Ka	ň	05/25/21 10:45	05/25/21 14:49	
PCB-1242			12	2.0	ug/Kg	۰۰۰۰۰۰ بر	05/25/21 10:45	05/25/21 14:49	
DCB 1242			12	2.0	ug/Kg	*	05/25/21 10:45	05/25/21 14:49	
DCB 1254			12	2.0	ug/Kg	ж ж	05/25/21 10:45	05/25/21 14:49	
PCB-1254 PCB-1260	ND		12	2.0 2.6	ug/Kg ug/Kg	¥ ¢	05/25/21 10:45	05/25/21 14:49	
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fa
Tetrachloro-m-xylene	75		22 - 131				05/25/21 10:45	05/25/21 14:49	-
DCB Decachlorobiphenyl (Surr)	81		32 - 150				05/25/21 10:45	05/25/21 14:49	
Method: NWTPH-Dx - Northw	est - Semi-V	olatile Pet	roleum Prod	ucts (GC	C)				
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics (DRO) (C10-C25)	ND		12	5.1	mg/Kg	¢	05/25/21 16:53	05/25/21 21:29	
Residual Range Organics (RRO) (C25-C36)	8.3	J	30	6.0	mg/Kg	¢	05/25/21 16:53	05/25/21 21:29	
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fa
o-Terphenyl	77		50 - 150				05/25/21 16:53	05/25/21 21:29	
n-Triacontane-d62	68		50 - 150				05/25/21 16:53	05/25/21 21:29	
Method: 6020B - Metals (ICP/I	MS)	0			11	_	Durand	•	D'I E -
Analyte	Result	Qualifier	RL	MDL	Unit	<u> </u>	Prepared	Analyzed	
Cadmium	0.076	J	0.65	0.062	mg/Kg	ф.	05/22/21 08:19	05/25/21 04:36	1
Chromium	15		0.81	0.051	mg/Kg	¢	05/22/21 08:19	05/25/21 04:36	1
Lead	6.6		0.40	0.039	mg/Kg	æ.	05/22/21 08:19	05/25/21 04:36	1
Nickel	15		0.40	0.16	mg/Kg	ţ.	05/22/21 08:19	05/25/21 04:36	1
Zinc	42		4.4	1.3	mg/Kg	\$	05/22/21 08:19	05/25/21 04:36	1
Client Sample ID: SB2-1-0	)511					L	.ab Sample	D: 590-15 Hotrix	5130-8
ate Received: 05/13/21 10:00								Percent Solid	ls: 79.(
Method: 8260D - Volatile Orga	anic Compo	unds by G	C/MS						
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fa
1,1,1,2-Tetrachloroethane	ND		0.13	0.026	mg/Kg	☆	05/24/21 17:52	05/24/21 22:55	
1,1,1-Trichloroethane	ND		0.13	0.023	mg/Kg	☆	05/24/21 17:52	05/24/21 22:55	
1,1,2,2-Tetrachloroethane	ND		0.13	0.039	mg/Kg	☆	05/24/21 17:52	05/24/21 22:55	
1,1,2-Trichloroethane	ND		0.13	0.047	mg/Kg	¢	05/24/21 17:52	05/24/21 22:55	
1,1-Dichloroethane	ND		0.13	0.035	mg/Kg	₽	05/24/21 17:52	05/24/21 22:55	
1,1-Dichloroethene	ND		0.13	0.045	mg/Kg	₽	05/24/21 17:52	05/24/21 22:55	
1,1-Dichloropropene	ND		0.13	0.023	mg/Kg	¢	05/24/21 17:52	05/24/21 22:55	
1,2,3-Trichlorobenzene	ND		0.13	0.044	mg/Kg	☆	05/24/21 17:52	05/24/21 22:55	
1,2,3-Trichloropropane	ND		0.27	0.049	mg/Kg	¢	05/24/21 17:52	05/24/21 22:55	
1,2,4-Trichlorobenzene	ND		0.13	0.025	mg/Kg	¢	05/24/21 17:52	05/24/21 22:55	
1,2,4-Trimethylbenzene	ND		0.13	0.031	mg/Kg	¢	05/24/21 17:52	05/24/21 22:55	
1.2-Dibromo-3-Chloropropane	ND		0.67	0 080	ma/Ka	÷	05/24/21 17:52	05/24/21 22:55	
			0.01	0.000	ing/ite	- m	00/2 //2 / //02		

Eurofins TestAmerica, Spokane

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0.13

0.13

0.031 mg/Kg

0.020 mg/Kg

ND

ND

1

Client: BGES, Inc. Project/Site: Othello, WA

### Client Sample ID: SB2-1-0511 Date Collected: 05/11/21 10:14 Date Received: 05/13/21 10:00

## Lab Sample ID: 590-15130-8

Matrix: Solid Percent Solids: 79.0

> 5 6

Method: 8260D - Volatile O	rganic Compo	unds by G	C/MS (Contin	ued)					
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dichloropropane	ND		0.16	0.040	mg/Kg	<u></u>	05/24/21 17:52	05/24/21 22:55	1
1,3,5-Trimethylbenzene	ND		0.13	0.043	mg/Kg	☆	05/24/21 17:52	05/24/21 22:55	1
1,3-Dichlorobenzene	ND		0.13	0.017	mg/Kg	☆	05/24/21 17:52	05/24/21 22:55	1
1,3-Dichloropropane	ND		0.13	0.040	mg/Kg	¢	05/24/21 17:52	05/24/21 22:55	1
1,4-Dichlorobenzene	ND		0.13	0.027	mg/Kg	₽	05/24/21 17:52	05/24/21 22:55	1
2,2-Dichloropropane	ND		0.13	0.032	mg/Kg	¢	05/24/21 17:52	05/24/21 22:55	1
2-Chlorotoluene	ND		0.13	0.022	mg/Kg	¢	05/24/21 17:52	05/24/21 22:55	1
4-Chlorotoluene	ND		0.13	0.012	mg/Kg	¢	05/24/21 17:52	05/24/21 22:55	1
4-Isopropyltoluene	ND		0.13	0.027	mg/Kg	¢	05/24/21 17:52	05/24/21 22:55	1
Benzene	ND		0.027	0.013	mg/Kg	¢	05/24/21 17:52	05/24/21 22:55	1
Bromobenzene	ND		0.13	0.030	mg/Kg		05/24/21 17:52	05/24/21 22:55	1
Bromoform	ND		0.27	0.025	mg/Kg	☆	05/24/21 17:52	05/24/21 22:55	1
Bromomethane	ND		0.67	0.044	mg/Kg	☆	05/24/21 17:52	05/24/21 22:55	1
Carbon tetrachloride	ND		0.13	0.015	mg/Kg	∴	05/24/21 17:52	05/24/21 22:55	1
Chlorobenzene	ND		0.13	0.028	mg/Kg	¢	05/24/21 17:52	05/24/21 22:55	1
Chlorobromomethane	ND		0.13	0.053	mg/Kg	¢	05/24/21 17:52	05/24/21 22:55	1
Chlorodibromomethane	ND		0.27	0.022	mg/Kg		05/24/21 17:52	05/24/21 22:55	1
Chloroethane	ND		0.27	0.075	mg/Kg	¢	05/24/21 17:52	05/24/21 22:55	1
Chloroform	ND		0.13	0.031	ma/Ka	¢	05/24/21 17:52	05/24/21 22:55	1
Chloromethane	ND		0.67	0.055	mg/Kg		05/24/21 17:52	05/24/21 22:55	1
cis-1.2-Dichloroethene	ND		0.13	0.028	ma/Ka	ġ.	05/24/21 17:52	05/24/21 22:55	1
cis-1.3-Dichloropropene	ND		0.13	0.027	ma/Ka	±	05/24/21 17:52	05/24/21 22:55	1
Dibromomethane	ND		0.13	0.030	ma/Ka		05/24/21 17:52	05/24/21 22:55	
Dichlorobromomethane	ND		0.13	0.083	ma/Ka	ġ.	05/24/21 17:52	05/24/21 22:55	1
Dichlorodifluoromethane	ND		0.13	0.037	ma/Ka	÷	05/24/21 17:52	05/24/21 22:55	1
Ethylbenzene	ND		0.13	0.022	ma/Ka		05/24/21 17:52	05/24/21 22:55	
Ethylene Dibromide	ND		0.13	0.045	ma/Ka	÷.	05/24/21 17:52	05/24/21 22:55	1
Hexachlorobutadiene	ND		0.13	0.022	ma/Ka	±	05/24/21 17:52	05/24/21 22:55	1
Isopropylbenzene	ND		0.13	0.041	ma/Ka		05/24/21 17:52	05/24/21 22:55	1
Methyl tert-butyl ether	ND		0.067	0.040	ma/Ka	÷.	05/24/21 17:52	05/24/21 22:55	1
Methylene Chloride	ND		0 47	0.27	ma/Ka	÷.	05/24/21 17:52	05/24/21 22:55	1
m-Xvlene & p-Xvlene	ND		0.53	0.038	ma/Ka		05/24/21 17:52	05/24/21 22:55	
Naphthalene	ND		0.27	0.037	ma/Ka	÷.	05/24/21 17:52	05/24/21 22:55	1
n-Butylbenzene	ND		0.13	0.037	ma/Ka	÷.	05/24/21 17:52	05/24/21 22:55	1
N-Propylbenzene	ND		0.13	0.035	ma/Ka		05/24/21 17:52	05/24/21 22:55	
o-Xvlene	ND		0.27	0.031	ma/Ka	ġ.	05/24/21 17:52	05/24/21 22:55	1
sec-Butylbenzene	ND		0.13	0.025	ma/Ka	÷.	05/24/21 17:52	05/24/21 22:55	1
Styrene	ND		0.13	0.031	ma/Ka		05/24/21 17:52	05/24/21 22:55	1
tert-Butylbenzene	ND		0.13	0.026	ma/Ka	-0- -0-	05/24/21 17:52	05/24/21 22:55	1
Tetrachloroethene	ND		0.053	0.023	ma/Ka	÷.	05/24/21 17:52	05/24/21 22:55	1
Toluene	ND		0.13	0.018	ma/Ka		05/24/21 17:52	05/24/21 22:55	1
trans-1 2-Dichloroethene	ND		0.13	0.030	ma/Ka	-0- -0-	05/24/21 17:52	05/24/21 22:55	1
trans-1.3-Dichloropropene	ND		0.13	0.035	ma/Ka	÷.	05/24/21 17:52	05/24/21 22:55	1
Trichloroethene	ND		0.033	0.010	mg/Ka		05/24/21 17:52	05/24/21 22:55	· · · · · · · · · · · · · · · · · · ·
Trichlorofluoromethane			0.27	0 044	mg/Ka	т т	05/24/21 17:52	05/24/21 22:55	1
Vinyl chloride			0.080	0 027	ma/Ka	~~ بند	05/24/21 17:52	05/24/21 22:55	1
	ND		0.000	0.021		<del>بر</del>	55127121 11.5Z	55/27/21 ZZ.00	
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	101		75 - 129				05/24/21 17:52	05/24/21 22:55	1
4-Bromofluorobenzene (Surr)	105		76 - 122				05/24/21 17:52	05/24/21 22:55	1

### Client Sample ID: SB2-1-0511 Date Collected: 05/11/21 10:14 Date Received: 05/13/21 10:00

Lab Sample	e ID:	590-15130-8
		Matrix: Solid
	Perce	ent Solids: 79.0

Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
Dibromofluoromethane (Surr)	100		80 - 120				05/24/21 17:52	05/24/21 22:55	1
Toluene-d8 (Surr)	104		80 - 120				05/24/21 17:52	05/24/21 22:55	1
Method: NWTPH-Gx - Nort	hwest - Volatile	Petroleu	m Products (	GC/MS)					
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline	ND		6.7	2.4	mg/Kg	☆	05/24/21 17:52	05/24/21 22:55	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	105		41.5 - 162				05/24/21 17:52	05/24/21 22:55	1
Method: 8270E SIM - Semi	volatile Organi	c Compou	inds (GC/MS	SIM)					
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1-Methylnaphthalene	ND		12	2.7	ug/Kg	¢	05/24/21 11:33	05/24/21 21:27	1
2-Methylnaphthalene	ND		12	3.8	ug/Kg	¢	05/24/21 11:33	05/24/21 21:27	1
Acenaphthene	ND		12	3.1	ug/Kg	₽	05/24/21 11:33	05/24/21 21:27	1
Acenaphthylene	ND		12	4.1	ug/Kg	₿	05/24/21 11:33	05/24/21 21:27	1
Anthracene	ND		12	2.4	ug/Kg	☆	05/24/21 11:33	05/24/21 21:27	1
Benzo[a]anthracene	ND		12	2.6	ug/Kg	☆	05/24/21 11:33	05/24/21 21:27	1
Benzo[a]pyrene	ND		12	5.2	ug/Kg	¢	05/24/21 11:33	05/24/21 21:27	1
Benzo[b]fluoranthene	ND		12	4.3	ug/Kg	₽	05/24/21 11:33	05/24/21 21:27	1
Benzo[g,h,i]perylene	ND		12	2.9	ug/Kg	¢	05/24/21 11:33	05/24/21 21:27	1
Benzo[k]fluoranthene	ND		12	3.1	ug/Kg	¢	05/24/21 11:33	05/24/21 21:27	1
Chrysene	ND		12	1.9	ug/Kg	¢	05/24/21 11:33	05/24/21 21:27	1
Dibenz(a,h)anthracene	ND		12	3.5	ug/Kg	¢	05/24/21 11:33	05/24/21 21:27	1
Fluoranthene	ND		12	3.0	ug/Kg	¢.	05/24/21 11:33	05/24/21 21:27	1
Fluorene	ND		12	2.7	ug/Kg	¢	05/24/21 11:33	05/24/21 21:27	1
Indeno[1,2,3-cd]pyrene	ND		12	3.6	ug/Kg	¢	05/24/21 11:33	05/24/21 21:27	1
Naphthalene	ND		12	2.6	ug/Kg	¢	05/24/21 11:33	05/24/21 21:27	1
Phenanthrene	ND		12	4.4	uq/Kq	¢	05/24/21 11:33	05/24/21 21:27	1
Pyrene	ND		12	4.7	ug/Kg	¢	05/24/21 11:33	05/24/21 21:27	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
2-Fluorobiphenyl (Surr)	90	· · · · · · · · · · · · · · · · · · ·	47 - 120				05/24/21 11:33	05/24/21 21:27	1
Nitrobenzene-d5	76		33 - 120				05/24/21 11:33	05/24/21 21:27	1
p-Terphenyl-d14	109		74 - 120				05/24/21 11:33	05/24/21 21:27	1
_ Method: 8011 - EDB, DBCF	P. and 1.2.3-TCI	P (GC)							
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analvzed	Dil Fac
1.2-Dibromoethane (EDB)	ND		0.10	0.044	ua/Ka	<u> </u>	05/25/21 11:10	05/25/21 22:17	1
			0.10	0.044	uging	*	00/20/21 11:10	00/20/21 22.11	I
Method: 8082A - Polychlor	inated Bipheny	/Is (PCBs)	by Gas Chro	matogr	aphy	_	Durand	A	
		Qualifier	KL		Unit	<u> </u>	Prepared		DIIFac
	ND		12	2.7	ug/Kg	¢.	05/25/21 10:45	05/25/21 15:10	1
FUB-1221	ND		12	2.7	ug/Kg	₩ 	05/25/21 10:45	05/25/21 15:10	1
PUB-1232	ND		12	2.7	ug/ĸg	¢.	05/25/21 10:45	05/25/21 15:10	1
PCB-1242	ND		12	2.7	ug/Kg	₽	05/25/21 10:45	05/25/21 15:10	1
PCB-1248	ND		12	2.7	ug/Kg	¢	05/25/21 10:45	05/25/21 15:10	1
PCB-1254	ND		12	2.7	ug/Kg	¢.	05/25/21 10:45	05/25/21 15:10	1
PCB-1260	ND		12	2.7	ug/Kg	¢	05/25/21 10:45	05/25/21 15:10	1

Client: BGES, Inc Project/Site:

### **Client Sar Date Collec Date Receiv**

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Project/Site: Othello, WA								000 12.000 1	0100 1
Client Sample ID: SB2-1-0	)511					L	ab Sample	D: 590-15	5130-8
Date Collected: 05/11/21 10:14								Matrix	: Solid
Date Received: 05/13/21 10:00								Percent Solid	ls: 79.0
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
Tetrachloro-m-xylene	76		22 - 131				05/25/21 10:45	05/25/21 15:10	1
DCB Decachlorobiphenyl (Surr)	79		32 - 150				05/25/21 10:45	05/25/21 15:10	1
Mothod: NW/TPH Dx Northw	act Sami V	olatila Dat	roloum Brod	uete (Cl					
Analyto	est - Jeili-v	Ouglifier			<b>-)</b> Unit	п	Proparad	Analyzod	Dil Eac
Diosol Bango Organics (DBO)		Quaimer	13	5.2		— <u>–</u>	05/25/21 16:53	05/25/21 22:11	
(C10-C25)	ND		15	5.2	ilig/itg	74	03/23/21 10.33	05/25/21 22.11	1
Residual Range Organics (RRO) (C25-C36)	6.7	J	31	6.3	mg/Kg	¢	05/25/21 16:53	05/25/21 22:11	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
o-Terphenyl	80		50 - 150				05/25/21 16:53	05/25/21 22:11	1
n-Triacontane-d62	71		50 - 150				05/25/21 16:53	05/25/21 22:11	1
Method: 6020B - Metals (ICP/	MS)								
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	0.074	J	0.53	0.051	mg/Kg		05/22/21 08:19	05/25/21 04:40	10
Chromium	14		0.67	0.042	mg/Kg	¢	05/22/21 08:19	05/25/21 04:40	10
Lead	5.9		0.33	0.032	mg/Kg	₽	05/22/21 08:19	05/25/21 04:40	10
Nickel	14		0.33	0.13	mg/Kg	¢	05/22/21 08:19	05/25/21 04:40	10
Zinc	41		3.7	1.1	mg/Kg	₽	05/22/21 08:19	05/25/21 04:40	10
Client Sample ID: SB3-1-0	)511					L	ab Sample	D: 590-15	5130-9
Date Collected: 05/11/21 10:22							-	Matrix	: Solid
								Percent Solid	15: 77.3
Method: 8260D - Volatile Orga	anic Compo	unds by G	C/MS			_	<b>_</b> .		
	Result	Qualifier	RL	MDL	Unit	<u> </u>	Prepared	Analyzed	Dil Fac
	ND		0.14	0.027	mg/Kg	\$ <del>.</del>	05/24/21 17:52	05/24/21 23:17	1
	ND		0.14	0.024	mg/Kg	\$ <del>.</del>	05/24/21 17:52	05/24/21 23:17	1
	ND		0.14	0.041	mg/Kg	ф.	05/24/21 17:52	05/24/21 23:17	۱ ۲
	ND		0.14	0.049	mg/Kg	\$ <del>.</del>	05/24/21 17:52	05/24/21 23:17	1
	ND		0.14	0.037	mg/Kg	\$ <del>.</del>	05/24/21 17:52	05/24/21 23:17	1
	ND		0.14	0.048	mg/Kg		05/24/21 17:52	05/24/21 23:17	1
	ND		0.14	0.024	mg/Kg	\$ <del>.</del>	05/24/21 17:52	05/24/21 23:17	1
1,2,3-Trichlorobenzene	ND		0.14	0.047	mg/Kg	\$	05/24/21 17:52	05/24/21 23:17	1
1,2,3-Trichloropropane	ND		0.28	0.051	mg/Kg	÷	05/24/21 17:52	05/24/21 23:17	1
1,2,4-Irichlorobenzene	ND		0.14	0.026	mg/Kg	Ϋ́	05/24/21 17:52	05/24/21 23:17	1
1,2,4-Irimethylbenzene	ND		0.14	0.033	mg/Kg	¢	05/24/21 17:52	05/24/21 23:17	1
1,2-Dibromo-3-Chloropropane	ND		0.70	0.084	mg/Kg	¢	05/24/21 17:52	05/24/21 23:17	1
1,2-Dichlorobenzene	ND		0.14	0.033	mg/Kg	☆	05/24/21 17:52	05/24/21 23:17	1
1,2-Dichloroethane	ND		0.14	0.022	mg/Kg	☆	05/24/21 17:52	05/24/21 23:17	1
1,2-Dichloropropane	ND		0.17	0.042	mg/Kg	¢	05/24/21 17:52	05/24/21 23:17	1
1,3,5-Trimethylbenzene	ND		0.14	0.045	mg/Kg	¢	05/24/21 17:52	05/24/21 23:17	1
1,3-Dichlorobenzene	ND		0.14	0.018	mg/Kg	¢	05/24/21 17:52	05/24/21 23:17	1
1,3-Dichloropropane	ND		0.14	0.041	mg/Kg	¢	05/24/21 17:52	05/24/21 23:17	1

1,3-Dichlorop 1,4-Dichlorobenzene ND 0.14 0.029 mg/Kg 05/24/21 17:52 05/24/21 23:17
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 ND 0.028 0.014 mg/Kg Benzene 1

Client: BGES, Inc. Project/Site: Othello, WA

### Client Sample ID: SB3-1-0511 Date Collected: 05/11/21 10:22 Date Received: 05/13/21 10:00

## Lab Sample ID: 590-15130-9

Matrix: Solid Percent Solids: 77.3

Analvte	Result	Qualifier	RL	MDI	Unit	D	Prepared	Analyzed	Dil Fac
Bromobenzene			0.14	0.031	mg/Ka		05/24/21 17:52	05/24/21 23.17	1
Bromoform	ND		0.28	0.027	ma/Ka	. ۲ خ	05/24/21 17:52	05/24/21 23:17	· · · · · · · 1
Bromomethane	ND		0.70	0.046	ma/Ka	÷	05/24/21 17:52	05/24/21 23:17	1
Carbon tetrachloride	ND		0.14	0.015	ma/Ka		05/24/21 17:52	05/24/21 23:17	
Chlorobenzene	ND		0.14	0.029	ma/Ka	Ť	05/24/21 17:52	05/24/21 23:17	1
Chlorobromomethane	ND		0.14	0.056	ma/Ka	-0-	05/24/21 17:52	05/24/21 23:17	1
Chlorodibromomethane	ND		0.28	0.023	ma/Ka		05/24/21 17:52	05/24/21 23:17	1
Chloroethane	ND		0.28	0.079	ma/Ka	÷	05/24/21 17:52	05/24/21 23:17	1
Chloroform	ND		0.14	0.033	ma/Ka	÷	05/24/21 17:52	05/24/21 23.17	1
Chloromethane	ND		0.70	0.058	ma/Ka		05/24/21 17:52	05/24/21 23:17	· · · · · · · · 1
cis-1 2-Dichloroethene	ND		0.14	0.029	ma/Ka	÷	05/24/21 17:52	05/24/21 23:17	1
cis-1 3-Dichloropropene	ND		0.14	0.029	ma/Ka	Ť	05/24/21 17:52	05/24/21 23:17	1
Dibromomethane	ND		0 14	0.031	mg/Ka	. آ بل	05/24/21 17:52	05/24/21 23.17	· · · · · · · · · 1
Dichlorobromomethane	ND		0.14	0.087	mg/Ka	Ť	05/24/21 17:52	05/24/21 23.17	1
Dichlorodifluoromethane	ND		0.14	0.039	mg/Ka	Ť	05/24/21 17:52	05/24/21 23.17	1
Ethylbenzene	ND		0.14	0.023	mg/Ka	. آ خ	05/24/21 17:52	05/24/21 23.17	· · · · · · · 1
Ethylene Dibromide	ND		0.14	0.047	mg/Ka	÷	05/24/21 17:52	05/24/21 23.17	1
Hexachlorobutadiene	ND		0.14	0.023	mg/Ka	÷	05/24/21 17:52	05/24/21 23.17	1
sopropylbenzene			0.14	0.020	mg/Kg		05/24/21 17:52	05/24/21 23.17	· · · · · · · 1
Methyl tert-butyl ether			0.070	0.040	mg/Kg	т т	05/24/21 17:52	05/24/21 23:17	1
			0.070	0.042	mg/Kg	т т	05/24/21 17:52	05/24/21 23:17	1
m-Xylene & n-Xylene			0.45	0.20	mg/Kg		05/24/21 17:52	05/24/21 23:17	
Nanhthalene			0.00	0.040	mg/Kg	т т	05/24/21 17:52	05/24/21 23:17	1
			0.20	0.000	mg/Kg	т Ж	05/24/21 17:52	05/24/21 23:17	1
J-Propylbenzene	ND		0.14	0.000	mg/Kg		05/24/21 17:52	05/24/21 23:17	· · · · · · · 1
-Xvlene			0.14	0.007	mg/Kg	т т	05/24/21 17:52	05/24/21 23:17	1
sec-Butylbenzene			0.20	0.002	mg/Kg	т т	05/24/21 17:52	05/24/21 23:17	1
Styrene			0.14	0.020	mg/Kg		05/24/21 17:52	05/24/21 23:17	
ert-Butylbenzene			0.14	0.000	mg/Kg	~ *	05/24/21 17:52	05/24/21 23:17	1
Tetrachloroethene			0.056	0.027	mg/Kg	ж Ж	05/24/21 17:52	05/24/21 23:17	1
Foluene			0.000	0.020	mg/Kg		05/24/21 17:52	05/24/21 23:17	
rans-1 2-Dichloroethene			0.14	0.032	ma/Ka	*	05/24/21 17:52	05/24/21 23.17	1
rans-1 3-Dichloropropene			0.14	0.002	ma/Ka	*	05/24/21 17:52	05/24/21 23.17	1
Frichloroethene	םא חוא		0.14 0.035	0.037	mg/Kg	بر 	05/24/21 17.52	05/24/21 23.17	ا 1
Trichlorofluoromethane	םא שא		0.035	0.011	mg/Kg	·사	05/24/21 17.52	05/24/21 23.17	1
	םא חוא		0.20	0.040	mg/Kg	·사	05/24/21 17.52	05/24/21 23.17	1
	UN		0.004	0.020	mg/ng	났	03124121 11.32	0312412123.17	1
Surrogate	%Recoverv	Qualifier	Limits				Prepared	Analvzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	100		75 - 129				05/24/21 17:52	05/24/21 23:17	1
4-Bromofluorobenzene (Surr)	104		76 - 122				05/24/21 17:52	05/24/21 23:17	1
Dibromofluoromethane (Surr)	100		80 - 120				05/24/21 17:52	05/24/21 23:17	1
Toluene-d8 (Surr)	102		80 - 120				05/24/21 17:52	05/24/21 23:17	
. ,									
Method: NWTPH-Gx - North	nwest - Volatile	Petroleu	m Products (	GC/MS)					
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline	ND		7.0	2.5	mg/Kg	— <del>`</del>	05/24/21 17:52	05/24/21 23:17	1
Surrogate	%Recoverv	Qualifier	Limits				Prepared	Analyzed	Dil Fac
A-Bromofluorobenzene (Surr)	104		41.5 162				05/24/21 17:52	05/24/21 23.17	1

Client: BGES, Inc. Project/Site: Othello, WA

### Client Sample ID: SB3-1-0511 Date Collected: 05/11/21 10:22 Date Received: 05/13/21 10:00

### Lab Sample ID: 590-15130-9 Matrix: Solid

Percent Solids: 77.3

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Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1-Methylnaphthalene	ND		25	5.6	ug/Kg	— <u>-</u>	05/24/21 11:33	05/24/21 21:53	2
2-Methylnaphthalene	ND		25	7.8	ug/Kg	¢	05/24/21 11:33	05/24/21 21:53	2
Acenaphthene	ND		25	6.4	ug/Kg	¢	05/24/21 11:33	05/24/21 21:53	2
Acenaphthylene	ND		25	8.4	ug/Kg		05/24/21 11:33	05/24/21 21:53	2
Anthracene	ND		25	5.0	ug/Kg	¢	05/24/21 11:33	05/24/21 21:53	2
Benzo[a]anthracene	ND		25	5.4	ug/Kg	¢	05/24/21 11:33	05/24/21 21:53	2
Benzo[a]pyrene	ND		25	11	ug/Kg	 ¢	05/24/21 11:33	05/24/21 21:53	2
Benzo[b]fluoranthene	ND		25	8.8	ug/Kg	¢	05/24/21 11:33	05/24/21 21:53	2
Benzo[g,h,i]perylene	ND		25	5.9	ug/Kg	¢	05/24/21 11:33	05/24/21 21:53	2
Benzo[k]fluoranthene	ND		25	6.3	ug/Kg		05/24/21 11:33	05/24/21 21:53	2
Chrysene	ND		25	3.8	ug/Kg	¢	05/24/21 11:33	05/24/21 21:53	2
Dibenz(a,h)anthracene	ND		25	7.1	ug/Kg	¢	05/24/21 11:33	05/24/21 21:53	2
Fluoranthene	ND		25	6.3	ug/Kg		05/24/21 11:33	05/24/21 21:53	2
Fluorene	ND		25	5.6	ug/Kg	¢	05/24/21 11:33	05/24/21 21:53	2
Indeno[1,2,3-cd]pyrene	ND		25	7.5	ug/Kg	¢	05/24/21 11:33	05/24/21 21:53	2
Naphthalene	ND		25	5.4	ug/Kg		05/24/21 11:33	05/24/21 21:53	2
Phenanthrene	ND		25	9.1	ug/Kg	¢	05/24/21 11:33	05/24/21 21:53	2
Pyrene	ND		25	9.6	ug/Kg	¢	05/24/21 11:33	05/24/21 21:53	2
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
2-Fluorobiphenyl (Surr)	94		47 - 120				05/24/21 11:33	05/24/21 21:53	2
Nitrobenzene-d5	87		33 - 120				05/24/21 11:33	05/24/21 21:53	2
p-Terphenyl-d14	103		74 - 120				05/24/21 11:33	05/24/21 21:53	2
Method: 8011 - EDB, DBC	P, and 1,2,3-TC	P (GC)							
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.10	0.044	ug/Kg	¢	05/25/21 11:10	05/25/21 22:33	1
Method: 8082A - Polychic	orinated Biphen	yls (PCBs)	by Gas Chro	matogr	aphy				
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	ND		12	2.7	ug/Kg	<u></u>	05/25/21 10:45	05/25/21 15:31	1
PCB-1221	ND		12	2.7	ug/Kg	₽	05/25/21 10:45	05/25/21 15:31	1
PCB-1232	ND		12	2.7	ug/Kg	₽	05/25/21 10:45	05/25/21 15:31	1
PCB-1242	ND		12	2.7	ug/Kg	₽	05/25/21 10:45	05/25/21 15:31	1
PCB-1248	ND		12	2.7	ug/Kg	¢	05/25/21 10:45	05/25/21 15:31	1
PCB-1254	ND		12	2.7	ug/Kg	¢	05/25/21 10:45	05/25/21 15:31	1
PCB-1260	9.8	J	12	2.7	ug/Kg	¢	05/25/21 10:45	05/25/21 15:31	1

Surrogate	%Recovery Qua	lifier Limits
Tetrachloro-m-xylene	51	22 - 131
DCB Decachlorobiphenyl (Surr)	90	32 - 150

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics (DRO) (C10-C25)	660		12	5.2	mg/Kg		05/25/21 16:53	05/25/21 22:31	1
Residual Range Organics (RRO) (C25-C36)	960		31	6.2	mg/Kg	¢	05/25/21 16:53	05/25/21 22:31	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
o-Terphenyl	85		50 - 150				05/25/21 16:53	05/25/21 22:31	1

Eurofins TestAmerica, Spokane

Analyzed

Prepared

05/25/21 10:45 05/25/21 15:31

05/25/21 10:45 05/25/21 15:31

Dil Fac

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### Client Sample ID: SB3-1-0511 Date Collected: 05/11/21 10:22 Date Received: 05/13/21 10:00

### Job ID: 590-15130-1

### Lab Sample ID: 590-15130-9 Matrix: Solid

Percent Solids: 77.3

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Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
n-Triacontane-d62	80		50 - 150				05/25/21 16:53	05/25/21 22:31	1
_ Method: 6020B - Metals (ICI	P/MS)								
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	0.074	J	0.77	0.074	mg/Kg	— <u></u>	05/22/21 08:19	05/25/21 04:43	10
Chromium	15		0.96	0.061	mg/Kg	¢	05/22/21 08:19	05/25/21 04:43	10
Lead	5.9		0.48	0.046	mg/Kg	¢	05/22/21 08:19	05/25/21 04:43	10
Nickel	14		0.48	0.19	mg/Kg		05/22/21 08:19	05/25/21 04:43	10
Zinc	42		5.3	1.6	mg/Kg	¢	05/22/21 08:19	05/25/21 04:43	10
Client Sample ID: SB6-1	-0511					La	ab Sample	ID: 590-151	30-10
Date Collected: 05/11/21 11:3	9							Matrix	c: Solid
Date Received: 05/13/21 10:0	0							Percent Solid	ls: 76.9
-									
Method: 8260D - Volatile Or Analyte	ganic Compo Result	unds by G Qualifier	C/MS RI	мп	Unit	п	Prepared	Analyzed	Dil Fac
1 1 1 2-Tetrachloroethane			0 14	0 027	mg/Kg		05/24/21 17:52	05/24/21 23:38	1
1 1 1-Trichloroethane			0.14	0.021	ma/Ka	بر بہ	05/24/21 17:52	05/24/21 23:38	1
1 1 2 2-Tetrachloroethane	ND		0.14	0.024	ma/Ka	т ň	05/24/21 17:52	05/24/21 23:38	1
1 1 2-Trichloroethane	ND		0.14	0.049	mg/Kg		05/24/21 17:52	05/24/21 23:38	· · · · · · · · · 1
1 1-Dichloroethane			0.14	0.037	ma/Ka	т ň	05/24/21 17:52	05/24/21 23:38	1
1 1-Dichloroethene	ND		0.14	0.007	ma/Ka	т Ю	05/24/21 17:52	05/24/21 23:38	1
1 1-Dichloropropene	ND		0.14	0.024	ma/Ka		05/24/21 17:52	05/24/21 23:38	
1 2 3-Trichlorobenzene	ND		0.14	0.021	ma/Ka	т т	05/24/21 17:52	05/24/21 23:38	1
1 2 3-Trichloropropane	ND		0.28	0.051	ma/Ka	т Ю-	05/24/21 17:52	05/24/21 23:38	1
1 2 4-Trichlorobenzene	ND		0.14	0.026	ma/Ka		05/24/21 17:52	05/24/21 23:38	
1 2 4-Trimethylbenzene	ND		0.14	0.020	ma/Ka	т Ю-	05/24/21 17:52	05/24/21 23:38	1
1 2-Dibromo-3-Chloropropane	ND		0.70	0.084	ma/Ka	÷.	05/24/21 17:52	05/24/21 23:38	1
1 2-Dichlorobenzene	ND		0.14	0.032	ma/Ka		05/24/21 17:52	05/24/21 23:38	
1 2-Dichloroethane	ND		0.14	0.021	ma/Ka	÷.	05/24/21 17:52	05/24/21 23:38	1
1 2-Dichloropropane	ND		0.17	0.042	ma/Ka	-0-	05/24/21 17:52	05/24/21 23:38	1
1 3 5-Trimethylbenzene	ND		0.14	0.045	ma/Ka		05/24/21 17:52	05/24/21 23:38	
1.3-Dichlorobenzene	ND		0.14	0.018	ma/Ka	÷	05/24/21 17:52	05/24/21 23:38	1
1.3-Dichloropropane	ND		0.14	0.041	ma/Ka	÷.	05/24/21 17:52	05/24/21 23:38	1
1,4-Dichlorobenzene	ND		0.14	0.029	mg/Kg		05/24/21 17:52	05/24/21 23:38	
2,2-Dichloropropane	ND		0.14	0.034	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
2-Chlorotoluene	ND		0.14	0.023	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
4-Chlorotoluene	ND		0.14	0.012	mg/Kg		05/24/21 17:52	05/24/21 23:38	
4-Isopropyltoluene	ND		0.14	0.028	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Benzene	ND		0.028	0.014	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Bromobenzene	ND		0.14	0.031	mg/Kg	ф	05/24/21 17:52	05/24/21 23:38	1
Bromoform	ND		0.28	0.027	mg/Kg	☆	05/24/21 17:52	05/24/21 23:38	1
Bromomethane	ND		0.70	0.046	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Carbon tetrachloride	ND		0.14	0.015	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Chlorobenzene	ND		0.14	0.029	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Chlorobromomethane	ND		0.14	0.056	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Chlorodibromomethane	ND		0.28	0.023	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Chloroethane	ND		0.28	0.079	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Chloroform	ND		0.14	0.033	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Chloromethane	ND		0.70	0.058	mg/Kg	 ф	05/24/21 17:52	05/24/21 23:38	1

Eurofins TestAmerica, Spokane

Client: BGES, Inc. Project/Site: Othello, WA

### Client Sample ID: SB6-1-0511 Date Collected: 05/11/21 11:39 Date Received: 05/13/21 10:00

## Lab Sample ID: 590-15130-10

Matrix: Solid Percent Solids: 76.9

5

6

Method: 8260D - Volatile O	rganic Compo	unds by G	C/MS (Contir	nued)					
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.14	0.029	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
cis-1,3-Dichloropropene	ND		0.14	0.028	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Dibromomethane	ND		0.14	0.031	mg/Kg	₽	05/24/21 17:52	05/24/21 23:38	1
Dichlorobromomethane	ND		0.14	0.086	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Dichlorodifluoromethane	ND		0.14	0.039	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Ethylbenzene	ND		0.14	0.023	mg/Kg	₽	05/24/21 17:52	05/24/21 23:38	1
Ethylene Dibromide	ND		0.14	0.047	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Hexachlorobutadiene	ND		0.14	0.023	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Isopropylbenzene	ND		0.14	0.043	mg/Kg	₽	05/24/21 17:52	05/24/21 23:38	1
Methyl tert-butyl ether	ND		0.070	0.042	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Methylene Chloride	ND		0.49	0.28	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
m-Xylene & p-Xylene	ND		0.56	0.040	mg/Kg	₽	05/24/21 17:52	05/24/21 23:38	1
Naphthalene	ND		0.28	0.039	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
n-Butylbenzene	ND		0.14	0.038	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
N-Propylbenzene	ND		0.14	0.037	mg/Kg	₽	05/24/21 17:52	05/24/21 23:38	1
o-Xylene	ND		0.28	0.032	mg/Kg	₽	05/24/21 17:52	05/24/21 23:38	1
sec-Butylbenzene	ND		0.14	0.026	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Styrene	ND		0.14	0.033	mg/Kg	₽	05/24/21 17:52	05/24/21 23:38	1
tert-Butylbenzene	ND		0.14	0.027	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Tetrachloroethene	ND		0.056	0.024	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Toluene	ND		0.14	0.019	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
trans-1,2-Dichloroethene	ND		0.14	0.032	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
trans-1,3-Dichloropropene	ND		0.14	0.037	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Trichloroethene	ND		0.035	0.011	mg/Kg	₽	05/24/21 17:52	05/24/21 23:38	1
Trichlorofluoromethane	ND		0.28	0.046	mg/Kg	¢	05/24/21 17:52	05/24/21 23:38	1
Vinyl chloride	ND		0.084	0.028	mg/Kg	☆	05/24/21 17:52	05/24/21 23:38	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	100		75 - 129				05/24/21 17:52	05/24/21 23:38	1
4-Bromofluorobenzene (Surr)	113		76 - 122				05/24/21 17:52	05/24/21 23:38	1
Dibromofluoromethane (Surr)	98		80 - 120				05/24/21 17:52	05/24/21 23:38	1
Toluene-d8 (Surr)	104		80 - 120				05/24/21 17:52	05/24/21 23:38	1

#### Method: NWTPH-Gx - Northwest - Volatile Petroleum Products (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline	ND		7.0	2.5	mg/Kg	☆	05/24/21 17:52	05/24/21 23:38	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	113		41.5 - 162				05/24/21 17:52	05/24/21 23:38	1
Method: 8270E SIM - Semivol	atile Organi	c Compoi	unds (GC/MS	SIM)					
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1-Methylnaphthalene	ND		13	2.8	ug/Kg	¢	05/24/21 11:33	05/24/21 22:19	1
2-Methylnaphthalene	ND		13	3.9	ug/Kg	¢	05/24/21 11:33	05/24/21 22:19	1
Acenaphthene	ND		13	3.2	ug/Kg	¢	05/24/21 11:33	05/24/21 22:19	1
Acenaphthylene	ND		13	4.2	ug/Kg	₽	05/24/21 11:33	05/24/21 22:19	1
Anthracene	ND		13	2.5	ug/Kg	¢	05/24/21 11:33	05/24/21 22:19	1
Benzo[a]anthracene	ND		13	2.7	ug/Kg	₽	05/24/21 11:33	05/24/21 22:19	1
Benzo[a]pyrene	ND		13	5.3	ug/Kg	₽	05/24/21 11:33	05/24/21 22:19	1
Benzo[b]fluoranthene	ND		13	4.4	ug/Kg	¢	05/24/21 11:33	05/24/21 22:19	1

# Client Sample ID: SB6-1-0511 Date Collected: 05/11/21 11:39

### Lab Sample ID: 590-15130-10 Matrix: Solid

5 6 7

Date Received: 05/13/21 10:00								Percent Solid	ls: 76.9
Method: 8270E SIM - Semivol	atile Organi	c Compou	Inds (GC/MS	SIM) (Co	ontinued	)	Bronorod	Applyzod	Dil Eco
Analyte Ponzola h ilpondono		Quaimer				— <u>–</u>	05/04/01 11:00	Allalyzeu	
Benzolg,II,IJperviene			13	3.0	ug/Kg	۲۲ ۲	05/24/21 11.33	05/24/21 22.19	ا ۱
Chrysono			13	1.0	ug/Kg	ж Ж	05/24/21 11:33	05/24/21 22:19	1
Dihanz(a h)anthragana			13	1.9	ug/Kg	ж ж	05/24/21 11:33	05/24/21 22:19	1
			13	3.0	ug/Kg	۲۲ 	05/24/21 11.33	05/24/21 22:19	ا 1
Fluorance			13	J.1 2 Q	ug/Kg	ж Ж	05/24/21 11:33	05/24/21 22:19	1
			13	2.0	ug/Kg	·사 ·	05/24/21 11.33	05/24/21 22.19	1
Nanhthalene			13	27	ug/Kg	بر 	05/24/21 11:33	05/24/21 22:19	ا 1
Phononthropo			13	2.1	ug/Kg	*	05/24/21 11:33	05/24/21 22:19	1
Pyrene	ND		13	4.0	ug/Kg ug/Kg	Υ ¢	05/24/21 11:33	05/24/21 22:19	1
Surrogate	%Recoverv	Qualifier	Limits				Prepared	Analvzed	Dil Fac
2-Fluorobiphenyl (Surr)	82		47 - 120				05/24/21 11:33	05/24/21 22:19	1
Nitrobenzene-d5	65		33 - 120				05/24/21 11:33	05/24/21 22:19	1
p-Terphenyl-d14	103		74 - 120				05/24/21 11:33	05/24/21 22:19	1
_ Method: 8011 - EDB, DBCP, a	nd 1,2,3-TC	P (GC)							
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.10	0.045	ug/Kg	₽	05/25/21 11:10	05/25/21 22:50	1
_ Method: 8082A - Polychlorina	ted Bipheny	yls (PCBs)	by Gas Chro	omatogr	aphy				
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	ND		12	2.7	ug/Kg	¢	05/25/21 10:45	05/25/21 15:52	1
PCB-1221	ND		12	2.7	ug/Kg	¢	05/25/21 10:45	05/25/21 15:52	1
PCB-1232	ND		12	2.7	ug/Kg	¢	05/25/21 10:45	05/25/21 15:52	1
PCB-1242	ND		12	2.7	ug/Kg	¢	05/25/21 10:45	05/25/21 15:52	1
PCB-1248	ND		12	2.7	ug/Kg	¢	05/25/21 10:45	05/25/21 15:52	1
PCB-1254	ND		12	2.7	ug/Kg	\$	05/25/21 10:45	05/25/21 15:52	1
PCB-1260	ND		12	2.7	ug/Kg	¢	05/25/21 10:45	05/25/21 15:52	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
Tetrachloro-m-xylene	77		22 - 131				05/25/21 10:45	05/25/21 15:52	1
DCB Decachlorobiphenyl (Surr)	78		32 - 150				05/25/21 10:45	05/25/21 15:52	1
Method: NWTPH-Dx - Northw	est - Semi-V	olatile Pet	roleum Prod	ucts (G0	C)				
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics (DRO) (C10-C25)	ND		12	5.2	mg/Kg	¢	05/25/21 16:53	05/25/21 22:52	1
Residual Range Organics (RRO) (C25-C36)	15	J	31	6.2	mg/Kg	¢	05/25/21 16:53	05/25/21 22:52	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
o-rerphenyl	80		50 - 150				05/25/21 16:53	05/25/21 22:52	1
n-1riacontane-062 	81		50 - 150				05/25/21 16:53	05/25/21 22:52	1
Method: 6020B - Metals (ICP/	MS)	Qualifier			11	~	Due y and d	A mak	
Analyte	Result	Qualitier	KL	MDL	Unit	D	Prepared	Analyzed	

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		0.92	0.089	mg/Kg	¢	05/22/21 08:19	05/25/21 04:47	10
Chromium	17		1.2	0.073	mg/Kg	₽	05/22/21 08:19	05/25/21 04:47	10
Lead	6.9		0.58	0.055	mg/Kg	☆	05/22/21 08:19	05/25/21 04:47	10
Nickel	17		0.58	0.22	mg/Kg	₽	05/22/21 08:19	05/25/21 04:47	10
Zinc	49		6.3	1.9	mg/Kg	¢	05/22/21 08:19	05/25/21 04:47	10

### Client Sample ID: SB8-1-0511 Date Collected: 05/11/21 12:52 Date Received: 05/13/21 10:00

# Lab Sample ID: 590-15130-11

Matrix: Solid Percent Solids: 77.5

Method: 8260D - Volatile Org	anic Compounds by (	GC/MS			_	<b>_</b> .			E
Analyte	Result Qualifier	- <u> </u>		Unit	<u> </u>	Prepared	Analyzed		5
1,1,1,2- letrachloroethane	ND	0.12	0.022	mg/Kg		05/24/21 17:52	05/25/21 00:00	1	0
	ND	0.12	0.020	mg/Kg	÷¢	05/24/21 17:52	05/25/21 00:00	1	0
	ND	0.12	0.034	mg/Kg	÷	05/24/21 17:52	05/25/21 00:00	1	
1,1,2-Irichloroethane	ND	0.12	0.041	mg/Kg	æ	05/24/21 17:52	05/25/21 00:00	1	
	ND	0.12	0.030	mg/Kg	\$ <del>2</del>	05/24/21 17:52	05/25/21 00:00	1	
	ND	0.12	0.039	mg/Kg	÷	05/24/21 17:52	05/25/21 00:00	1	8
1,1-Dicnioropropene	ND	0.12	0.020	mg/Kg	\$ 	05/24/21 17:52	05/25/21 00:00	1	
	ND	0.12	0.039	mg/Kg	-Q-	05/24/21 17:52	05/25/21 00:00	1	9
1,2,3-Trichloropropane	ND	0.23	0.042	mg/Kg	÷	05/24/21 17:52	05/25/21 00:00	1	
	ND	0.12	0.021	mg/Kg	-Q-	05/24/21 17:52	05/25/21 00:00	1	
	ND	0.12	0.027	mg/Kg	\$ 	05/24/21 17:52	05/25/21 00:00	1	
1,2-Dibromo-3-Chioropropane	ND	0.58	0.069	mg/Kg		05/24/21 17:52	05/25/21 00:00		
1,2-Dichlorobenzene	ND	0.12	0.027	mg/Kg	-Q-	05/24/21 17:52	05/25/21 00:00	1	
1,2-Dichloroethane	ND	0.12	0.018	mg/Kg	÷¢	05/24/21 17:52	05/25/21 00:00	1	
1,2-Dicnioropropane	ND	0.14	0.035	mg/Kg	÷÷	05/24/21 17:52	05/25/21 00:00	1	
1,3,5-Irimethylbenzene	ND	0.12	0.037	mg/Kg	÷.	05/24/21 17:52	05/25/21 00:00	1	
1,3-Dichlorobenzene	ND	0.12	0.015	mg/Kg	÷.	05/24/21 17:52	05/25/21 00:00	1	
1,3-Dichloropropane	ND	0.12	0.034	mg/Kg		05/24/21 17:52	05/25/21 00:00	1	
1,4-Dichlorobenzene	ND	0.12	0.024	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
2,2-Dichloropropane	ND	0.12	0.028	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
2-Chlorotoluene	ND	0.12	0.019	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
4-Chlorotoluene	ND	0.12	0.010	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
4-Isopropyltoluene	ND	0.12	0.024	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Benzene	ND	0.023	0.012	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Bromobenzene	ND	0.12	0.026	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Bromoform	ND	0.23	0.022	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Bromomethane	ND	0.58	0.038	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Carbon tetrachloride	ND	0.12	0.013	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Chlorobenzene	ND	0.12	0.024	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Chlorobromomethane	ND	0.12	0.046	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Chlorodibromomethane	ND	0.23	0.019	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Chloroethane	ND	0.23	0.065	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Chloroform	ND	0.12	0.027	mg/Kg	☆	05/24/21 17:52	05/25/21 00:00	1	
Chloromethane	ND	0.58	0.048	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
cis-1,2-Dichloroethene	ND	0.12	0.024	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
cis-1,3-Dichloropropene	ND	0.12	0.024	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Dibromomethane	ND	0.12	0.026	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Dichlorobromomethane	ND	0.12	0.072	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Dichlorodifluoromethane	ND	0.12	0.032	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Ethylbenzene	ND	0.12	0.019	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Ethylene Dibromide	ND	0.12	0.039	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Hexachlorobutadiene	ND	0.12	0.019	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Isopropylbenzene	ND	0.12	0.036	mg/Kg	₽	05/24/21 17:52	05/25/21 00:00	1	
Methyl tert-butyl ether	ND	0.058	0.035	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Methylene Chloride	ND	0.40	0.23	mg/Kg	\$	05/24/21 17:52	05/25/21 00:00	1	
m-Xylene & p-Xylene	ND	0.46	0.033	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
Naphthalene	ND	0.23	0.032	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
n-Butylbenzene	ND	0.12	0.032	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	
N-Propylbenzene	ND	0.12	0.030	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1	

### Client Sample ID: SB8-1-0511 Date Collected: 05/11/21 12:52 Date Received: 05/13/21 10:00

### Lab Sample ID: 590-15130-11 Matrix: Solid

Percent Solids: 77.5

5

6

Method: 8260D - Volatile O	rganic Compo	unds by G	C/MS (Conti	nued)					
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
o-Xylene	ND		0.23	0.027	mg/Kg	☆	05/24/21 17:52	05/25/21 00:00	1
sec-Butylbenzene	ND		0.12	0.021	mg/Kg	₽	05/24/21 17:52	05/25/21 00:00	1
Styrene	ND		0.12	0.027	mg/Kg	₽	05/24/21 17:52	05/25/21 00:00	1
tert-Butylbenzene	ND		0.12	0.023	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1
Tetrachloroethene	ND		0.046	0.020	mg/Kg	₽	05/24/21 17:52	05/25/21 00:00	1
Toluene	ND		0.12	0.015	mg/Kg	₽	05/24/21 17:52	05/25/21 00:00	1
trans-1,2-Dichloroethene	ND		0.12	0.026	mg/Kg	₽	05/24/21 17:52	05/25/21 00:00	1
trans-1,3-Dichloropropene	ND		0.12	0.030	mg/Kg	₽	05/24/21 17:52	05/25/21 00:00	1
Trichloroethene	ND		0.029	0.0088	mg/Kg	₿	05/24/21 17:52	05/25/21 00:00	1
Trichlorofluoromethane	ND		0.23	0.038	mg/Kg	₽	05/24/21 17:52	05/25/21 00:00	1
Vinyl chloride	ND		0.069	0.023	mg/Kg	¢	05/24/21 17:52	05/25/21 00:00	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	101		75 - 129				05/24/21 17:52	05/25/21 00:00	1
4-Bromofluorobenzene (Surr)	102		76 - 122				05/24/21 17:52	05/25/21 00:00	1
Dibromofluoromethane (Surr)	103		80 - 120				05/24/21 17:52	05/25/21 00:00	1
Toluene-d8 (Surr)	100		80 - 120				05/24/21 17:52	05/25/21 00:00	1

#### Method: NWTPH-Gx - Northwest - Volatile Petroleum Products (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline	ND		5.8	2.1	mg/Kg		05/24/21 17:52	05/25/21 00:00	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	102		41.5 - 162				05/24/21 17:52	05/25/21 00:00	1

#### Method: 8270E SIM - Semivolatile Organic Compounds (GC/MS SIM)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1-Methylnaphthalene	ND		12	2.7	ug/Kg	<u></u>	05/24/21 11:33	05/24/21 22:45	1
2-Methylnaphthalene	ND		12	3.8	ug/Kg	¢	05/24/21 11:33	05/24/21 22:45	1
Acenaphthene	ND		12	3.1	ug/Kg	₽	05/24/21 11:33	05/24/21 22:45	1
Acenaphthylene	ND		12	4.0	ug/Kg	¢	05/24/21 11:33	05/24/21 22:45	1
Anthracene	ND		12	2.4	ug/Kg	¢	05/24/21 11:33	05/24/21 22:45	1
Benzo[a]anthracene	ND		12	2.6	ug/Kg	¢	05/24/21 11:33	05/24/21 22:45	1
Benzo[a]pyrene	ND		12	5.1	ug/Kg	¢	05/24/21 11:33	05/24/21 22:45	1
Benzo[b]fluoranthene	ND		12	4.3	ug/Kg	¢	05/24/21 11:33	05/24/21 22:45	1
Benzo[g,h,i]perylene	ND		12	2.8	ug/Kg	¢	05/24/21 11:33	05/24/21 22:45	1
Benzo[k]fluoranthene	ND		12	3.0	ug/Kg	¢	05/24/21 11:33	05/24/21 22:45	1
Chrysene	ND		12	1.8	ug/Kg	¢	05/24/21 11:33	05/24/21 22:45	1
Dibenz(a,h)anthracene	ND		12	3.4	ug/Kg	¢	05/24/21 11:33	05/24/21 22:45	1
Fluoranthene	ND		12	3.0	ug/Kg	¢	05/24/21 11:33	05/24/21 22:45	1
Fluorene	ND		12	2.7	ug/Kg	¢	05/24/21 11:33	05/24/21 22:45	1
Indeno[1,2,3-cd]pyrene	ND		12	3.6	ug/Kg	¢	05/24/21 11:33	05/24/21 22:45	1
Naphthalene	ND		12	2.6	ug/Kg		05/24/21 11:33	05/24/21 22:45	1
Phenanthrene	ND		12	4.4	ug/Kg	¢	05/24/21 11:33	05/24/21 22:45	1
Pyrene	ND		12	4.6	ug/Kg	¢	05/24/21 11:33	05/24/21 22:45	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
2-Fluorobiphenyl (Surr)	60		47 - 120				05/24/21 11:33	05/24/21 22:45	1
Nitrobenzene-d5	54		33 - 120				05/24/21 11:33	05/24/21 22:45	1
p-Terphenyl-d14	89		74 - 120				05/24/21 11:33	05/24/21 22:45	1

Job ID: 590-15130-1

#### Client: BGES, Inc. Project/Site: Othello, WA

1,1-Dichloroethane

1,1-Dichloroethene

1,1-Dichloropropene

1,2,3-Trichlorobenzene

1,2,3-Trichloropropane

1,2,4-Trichlorobenzene

1,2,4-Trimethylbenzene

### Client Sample ID: SB8-1-0511 Date Collected: 05/11/21 12:52 Date Received: 05/13/21 10:00

### Lab Sample ID: 590-15130-11 Matrix: Solid

Percent Solids: 77.5

5 6 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.10	0.044	ug/Kg	₿	05/25/21 11:10	05/25/21 23:06	1
Method: 8082A - Polychlorina	ated Bipheny	/Is (PCBs)	by Gas Chro	omatogr	aphy				
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	ND		13	2.8	ug/Kg	☆	05/25/21 10:45	05/25/21 16:13	1
PCB-1221	ND		13	2.8	ug/Kg	¢	05/25/21 10:45	05/25/21 16:13	1
PCB-1232	ND		13	2.8	ug/Kg	¢	05/25/21 10:45	05/25/21 16:13	1
PCB-1242	ND		13	2.8	ug/Kg	¢	05/25/21 10:45	05/25/21 16:13	1
PCB-1248	ND		13	2.8	ug/Kg	¢	05/25/21 10:45	05/25/21 16:13	1
PCB-1254	ND		13	2.8	ug/Kg	¢	05/25/21 10:45	05/25/21 16:13	1
PCB-1260	ND		13	2.8	ug/Kg	₽	05/25/21 10:45	05/25/21 16:13	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
Tetrachloro-m-xylene	70		22 - 131				05/25/21 10:45	05/25/21 16:13	1
DCB Decachlorobiphenyl (Surr)	76		32 - 150				05/25/21 10:45	05/25/21 16:13	1
Method: NWTPH-Dx - Northw	est - Semi-V	olatile Pet	roleum Prod	ucts (G(	2)				
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics (DRO)	6.8	J	12	5.2	mg/Kg	¢	05/25/21 16:53	05/25/21 23:13	1
(C10-C25)									
Residual Range Organics (RRO) (C25-C36)	36		31	6.1	mg/Kg	¢	05/25/21 16:53	05/25/21 23:13	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
o-Terphenyl	77		50 - 150				05/25/21 16:53	05/25/21 23:13	1
n-Triacontane-d62	80		50 - 150				05/25/21 16:53	05/25/21 23:13	1
Method: 6020B - Metals (ICP/	MS)								
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	0.073	J	0.72	0.070	mg/Kg	¢	05/22/21 08:19	05/25/21 04:51	10
Chromium	14		0.90	0.057	mg/Kg	¢	05/22/21 08:19	05/25/21 04:51	10
Lead	5.5		0.45	0.043	mg/Kg	¢	05/22/21 08:19	05/25/21 04:51	10
Nickel	13		0.45	0.17	mg/Kg	¢	05/22/21 08:19	05/25/21 04:51	10
Zinc	41		5.0	1.5	mg/Kg	¢	05/22/21 08:19	05/25/21 04:51	10
lient Sample ID: SB10-1	-0511					La	b Sample	ID: 590-151	30-12
ate Collected: 05/11/21 13:05								Matrix	c: Solid
ate Received: 05/13/21 10:00								Percent Solid	ls: 76.1
Method: 8260D - Volatile Orga	anic Compo	unds bv G	C/MS						
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	ND		0.12	0.023	mg/Kg	<u></u>	05/24/21 17:52	05/25/21 00:22	1
1,1,1-Trichloroethane	ND		0.12	0.021	mg/Kg	¢	05/24/21 17:52	05/25/21 00:22	1
1,1,2,2-Tetrachloroethane	ND		0.12	0.036	mg/Kg	¢	05/24/21 17:52	05/25/21 00:22	1
440 T : 11			0.12	0.042	malka	· · · · · · · · · · · · · · · · · · ·	05/24/21 17:52	05/25/21 00.22	

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0.041 mg/Kg

0.045 mg/Kg

0.023 mg/Kg

0.029 mg/Kg

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### Client Sample ID: SB10-1-0511 Date Collected: 05/11/21 13:05 Date Received: 05/13/21 10:00

## Lab Sample ID: 590-15130-12

Matrix: Solid Percent Solids: 76.1

Analyte	Result Qualif	ier RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac	5
1,2-Dibromo-3-Chloropropane	ND	0.61	0.073	mg/Kg	— <u> </u>	05/24/21 17:52	05/25/21 00:22	1	
1,2-Dichlorobenzene	ND	0.12	0.028	mg/Kg		05/24/21 17:52	05/25/21 00:22	1	6
1,2-Dichloroethane	ND	0.12	0.019	mg/Kg	¢	05/24/21 17:52	05/25/21 00:22	1	
1.2-Dichloropropane	ND	0.15	0.037	ma/Ka	¢	05/24/21 17:52	05/25/21 00:22	1	
1.3.5-Trimethylbenzene	ND	0.12	0.039	ma/Ka		05/24/21 17:52	05/25/21 00:22	1	
1 3-Dichlorobenzene	ND	0.12	0.015	ma/Ka	÷	05/24/21 17:52	05/25/21 00.22	1	0
1 3-Dichloropropane	ND	0.12	0.036	ma/Ka	-05-	05/24/21 17:52	05/25/21 00:22	1	Ō
1 4-Dichlorobenzene	ND	0.12	0.025	ma/Ka		05/24/21 17:52	05/25/21 00:22	· · · · · · · · · · · · · · · 1	
2 2-Dichloropropane	ND	0.12	0.030	ma/Ka	÷	05/24/21 17:52	05/25/21 00.22	1	9
2-Chlorotoluene	ND	0.12	0.020	ma/Ka	-05-	05/24/21 17:52	05/25/21 00:22	1	
4-Chlorotoluene	ND	0.12	0.011	ma/Ka		05/24/21 17:52	05/25/21 00:22		
4-Isopropyltoluene	ND	0.12	0.025	ma/Ka	т т	05/24/21 17:52	05/25/21 00:22	1	
Benzene	ND	0.024	0.012	ma/Ka	т т	05/24/21 17:52	05/25/21 00:22	1	
Bromobenzene	ND	0.12	0.012	ma/Ka		05/24/21 17:52	05/25/21 00:22		
Bromoform	ND	0.24	0.023	ma/Ka	т ň	05/24/21 17:52	05/25/21 00:22	1	
Bromomethane	ND	0.61	0.020	ma/Ka	т т	05/24/21 17:52	05/25/21 00:22	1	
Carbon tetrachloride	ND	0.01	0.040	ma/Ka		05/24/21 17:52	05/25/21 00:22		
Chlorobenzene	ND	0.12	0.010	ma/Ka	۰ ۲	05/24/21 17:52	05/25/21 00:22	1	
Chlorobromomethane		0.12	0.020	mg/Kg	~ *	05/24/21 17:52	05/25/21 00:22	1	
Chlorodibromomethane		0.12	0.043	mg/Kg	× ×	05/24/21 17:52	05/25/21 00:22		
Chloroothana		0.24	0.020	mg/Kg	*	05/24/21 17:52	05/25/21 00:22	1	
Chloroform		0.24	0.009	mg/Kg	ж ж	05/24/21 17:52	05/25/21 00.22	1	
Chloromothana		0.12	0.029	mg/Kg	بر 	05/24/21 17:52	05/25/21 00.22		
		0.01	0.001	mg/Kg	ж ж	05/24/21 17.52	05/25/21 00.22	1	
cis 1.3 Dichloropropopo		0.12	0.025	mg/Kg	ж ж	05/24/21 17:52	05/25/21 00.22	1	
Dibromomethene		0.12	0.023	mg/Kg	ېر 	05/24/21 17:52	05/25/21 00.22		
		0.12	0.027	mg/Kg	ᆦ	05/24/21 17.52	05/25/21 00.22	1	
Dichlorodifluoromothano		0.12	0.070	mg/Kg	ж ж	05/24/21 17:52	05/25/21 00.22	1	
		0.12	0.034	mg/Kg	ېر 	05/24/21 17.52	05/25/21 00.22		
Ethylone Dibromide		0.12	0.020	mg/Kg	父	05/24/21 17:52	05/25/21 00:22	1	
		0.12	0.041	mg/Kg	ېد س	05/24/21 17.52	05/25/21 00.22	1	
		0.12	0.020	mg/Kg	<del>بر</del>	05/24/21 17:52	05/25/21 00:22	· · · · · · · · · · · · · · · · · · ·	
Isopropyidenzene	ND	0.12	0.030	mg/kg	父	05/24/21 17:52	05/25/21 00:22	1	
Methylana Chlarida	ND	0.061	0.037	mg/Kg	よ た 一	05/24/21 17:52	05/25/21 00:22	1	
	ND	0.43	0.24	mg/Kg	· · · · · · · · · · · · · · · · · · ·	05/24/21 17:52	05/25/21 00:22	·····	
m-Xylene & p-Xylene	ND	0.49	0.035	mg/Kg	-\$2 -	05/24/21 17:52	05/25/21 00:22	1	
	ND	0.24	0.034	mg/Kg	\$2 	05/24/21 17:52	05/25/21 00:22	1	
N Drawdhangene		0.12	0.034	mg/kg	<del>بر</del>	05/24/21 17.52	05/25/21 00.22		
N-Propyidenzene	ND	0.12	0.032	mg/Kg	\$2 	05/24/21 17:52	05/25/21 00:22	1	
	ND	0.24	0.028	mg/Kg	\$2 	05/24/21 17:52	05/25/21 00:22	1	
sec-Butylbenzene	ND	0.12	0.023	mg/Kg	÷	05/24/21 17:52	05/25/21 00:22		
Styrene	ND	0.12	0.029	mg/Kg	æ	05/24/21 17:52	05/25/21 00:22	1	
	ND	0.12	0.024	mg/Kg	÷¢	05/24/21 17:52	05/25/21 00:22	1	
	ND	0.049	0.022	mg/Kg	÷	05/24/21 17:52	05/25/21 00:22	1	
	ND	0.12	0.016	mg/Kg	₽	05/24/21 17:52	05/25/21 00:22	1	
	ND	0.12	0.028	mg/Kg	÷.	05/24/21 17:52	05/25/21 00:22	1	
trans-1,3-Dichloropropene	ND	0.12	0.032	mg/Kg	÷	05/24/21 17:52	05/25/21 00:22	1	
	ND	0.031	0.0093	mg/Kg	¢	05/24/21 17:52	05/25/21 00:22	1	
Irichlorofluoromethane	ND	0.24	0.040	mg/Kg	¢	05/24/21 17:52	05/25/21 00:22	1	
Vinyl chloride	ND	0.073	0.025	mg/Kg	Þ	05/24/21 17:52	05/25/21 00:22	1	

Client: BGES, Inc. Project/Site: Othello WA

PCB-1260

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Client Sample ID: SB10-	1-0511					La	b Sample	ID: 590-151	30-12
Date Collected: 05/11/21 13:0	5							Matrix	: Solid
Date Received: 05/13/21 10:00	)							Percent Solid	s: 76.1
Surrogate	%Recoverv	Qualifier	Limits				Prepared	Analvzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	100		75 - 129				05/24/21 17:52	05/25/21 00:22	1
4-Bromofluorobenzene (Surr)	105		76 - 122				05/24/21 17:52	05/25/21 00:22	1
Dibromofluoromethane (Surr)	101		80 - 120				05/24/21 17:52	05/25/21 00:22	1
Toluene-d8 (Surr)	102		80 - 120				05/24/21 17:52	05/25/21 00:22	1
Method: NWTPH-Gx - North	west - Volatile	e Petroleu	m Products (	GC/MS)					
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline	ND		6.1	2.2	mg/Kg	\$	05/24/21 17:52	05/25/21 00:22	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	105		41.5 - 162				05/24/21 17:52	05/25/21 00:22	1
Method: 8270E SIM - Semivo	olatile Organi	c Compou	unds (GC/MS	SIM)					
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1-Methylnaphthalene	ND		13	2.8	ug/Kg	☆	05/24/21 11:33	05/24/21 23:12	1
2-Methylnaphthalene	ND		13	3.9	ug/Kg	☆	05/24/21 11:33	05/24/21 23:12	1
Acenaphthene	ND		13	3.2	ug/Kg	¢	05/24/21 11:33	05/24/21 23:12	1
Acenaphthylene	ND		13	4.2	ug/Kg	¢.	05/24/21 11:33	05/24/21 23:12	1
Anthracene	ND		13	2.5	ug/Kg	¢	05/24/21 11:33	05/24/21 23:12	1
Benzo[a]anthracene	ND		13	2.7	ug/Kg	¢	05/24/21 11:33	05/24/21 23:12	1
Benzo[a]pyrene	ND		13	5.3	ug/Kg		05/24/21 11:33	05/24/21 23:12	1
Benzo[b]fluoranthene	ND		13	4.4	ug/Kg	¢	05/24/21 11:33	05/24/21 23:12	1
Benzo[q,h,i]perylene	ND		13	3.0	ug/Kg	¢	05/24/21 11:33	05/24/21 23:12	1
Benzo[k]fluoranthene	ND		13	3.2	ug/Kg		05/24/21 11:33	05/24/21 23:12	
Chrvsene	ND		13	1.9	ua/Ka	¢	05/24/21 11:33	05/24/21 23:12	1
Dibenz(a,h)anthracene	ND		13	3.6	ua/Ka	÷.	05/24/21 11:33	05/24/21 23:12	1
Fluoranthene	ND		13	3.1	ua/Ka	÷.	05/24/21 11:33	05/24/21 23:12	1
Fluorene	ND		13	2.8	ua/Ka	÷.	05/24/21 11:33	05/24/21 23.12	1
Indeno[1,2,3-cd]pvrene	ND		13	3.8	ua/Ka	÷	05/24/21 11:33	05/24/21 23:12	1
Naphthalene	ND		13	27	ua/Ka		05/24/21 11:33	05/24/21 23.12	
Phenanthrene	ND		13	4.6	ua/Ka	-05-	05/24/21 11:33	05/24/21 23:12	1
Pyrene	ND		13	4.8	ug/Kg ug/Kg	¢	05/24/21 11:33	05/24/21 23:12	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
2-Fluorobiphenyl (Surr)			47 - 120				05/24/21 11:33	05/24/21 23:12	1
Nitrobenzene-d5	69		33 - 120				05/24/21 11:33	05/24/21 23:12	1
p-Terphenyl-d14	108		74 - 120				05/24/21 11:33	05/24/21 23:12	1
Method: 8011 - EDB, DBCP,	and 1,2,3-TC	P (GC)							
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.10	0.044	ug/Kg	¢	05/25/21 11:10	05/25/21 23:23	1
Method: 8082A - Polychlorin	ated Binhen	/Is (PCBs)	) by Gas Chro	matogr	anhv				
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	ND		13	2.8	ug/Kg	— <u> </u>	05/25/21 10:45	05/25/21 16:34	1
PCB-1221	ND		13	2.8	ug/Kg	¢	05/25/21 10:45	05/25/21 16:34	1
PCB-1232	ND		13	2.8	uq/Ka	₽	05/25/21 10:45	05/25/21 16:34	1
PCB-12/2	ND		13	2.8	ug/Ka	÷	05/25/21 10:45	05/25/21 16:34	1
1 00-1242				-					
PCB-1242	ND		13	2.8	ug/Ka	₽	05/25/21 10:45	05/25/21 16:34	1

Eurofins TestAmerica, Spokane

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2.8 ug/Kg

ND

1,3-Dichlorobenzene

1,3-Dichloropropane

1,4-Dichlorobenzene

2,2-Dichloropropane

2-Chlorotoluene

4-Chlorotoluene

Benzene

4-Isopropyltoluene

### **Client Sam Date Collecte Date Receive**

Client: BGES, Inc. Project/Site: Othello, WA								Job ID: 590-1	5130-1
Client Sample ID: SB10-1 Date Collected: 05/11/21 13:05	-0511					La	b Sample	ID: 590-151 Matrix	30-12 C: Solid
Date Received: 05/13/21 10:00								Percent Solic	ls: 76.1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
Tetrachloro-m-xylene	72		22 - 131				05/25/21 10:45	05/25/21 16:34	1
DCB Decachlorobiphenyl (Surr)	74		32 - 150				05/25/21 10:45	05/25/21 16:34	1
Method: NWTPH-Dx - Northw	est - Semi-V	olatile Pet	roleum Prod	ucts (GC	C)				
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics (DRO) (C10-C25)	ND		12	5.2	mg/Kg	¢	05/25/21 16:53	05/25/21 23:34	1
Residual Range Organics (RRO) (C25-C36)	24	J	31	6.2	mg/Kg	¢	05/25/21 16:53	05/25/21 23:34	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
o-Terphenyl	80		50 - 150				05/25/21 16:53	05/25/21 23:34	1
n-Triacontane-d62	75		50 - 150				05/25/21 16:53	05/25/21 23:34	1
Method: 6020B - Metals (ICP/	MS)								
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	0.12	J	0.75	0.072	mg/Kg	¢	05/22/21 08:19	05/25/21 04:55	10
Chromium	18		0.94	0.059	mg/Kg	¢	05/22/21 08:19	05/25/21 04:55	10
_ead	7.3		0.47	0.045	mg/Kg		05/22/21 08:19	05/25/21 04:55	10
Nickel	19		0.47	0.18	mg/Kg	¢	05/22/21 08:19	05/25/21 04:55	10
Zinc	48		5.1	1.5	mg/Kg	¢	05/22/21 08:19	05/25/21 04:55	10
lient Sample ID: SB13-1	-0511					La	b Sample	ID: 590-151	30-13
ate Collected: 05/11/21 14:35								Matrix Percent Solid	C: Solid
Method: 8260D - Volatile Orga	nic Compo	unde by G	C/MS						
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	ND		0.13	0.026	mg/Kg	¢	05/24/21 17:52	05/25/21 00:43	1
1,1,1-Trichloroethane	ND		0.13	0.023	mg/Kg	☆	05/24/21 17:52	05/25/21 00:43	1
I,1,2,2-Tetrachloroethane	ND		0.13	0.039	mg/Kg	\$	05/24/21 17:52	05/25/21 00:43	1
I,1,2-Trichloroethane	ND		0.13	0.047	mg/Kg	☆	05/24/21 17:52	05/25/21 00:43	1
I,1-Dichloroethane	ND		0.13	0.035	mg/Kg	☆	05/24/21 17:52	05/25/21 00:43	1
,1-Dichloroethene	ND		0.13	0.045	mg/Kg	☆	05/24/21 17:52	05/25/21 00:43	1
,1-Dichloropropene	ND		0.13	0.023	mg/Kg	☆	05/24/21 17:52	05/25/21 00:43	1
,2,3-Trichlorobenzene	ND		0.13	0.045	mg/Kg	₽	05/24/21 17:52	05/25/21 00:43	1
,2,3-Trichloropropane	ND		0.27	0.049	mg/Kg	₿	05/24/21 17:52	05/25/21 00:43	1
I,2,4-Trichlorobenzene	ND		0.13	0.025	mg/Kg	₽	05/24/21 17:52	05/25/21 00:43	1
1,2,4-Trimethylbenzene	ND		0.13	0.031	mg/Kg	☆	05/24/21 17:52	05/25/21 00:43	1
1,2-Dibromo-3-Chloropropane	ND		0.67	0.080	mg/Kg	☆	05/24/21 17:52	05/25/21 00:43	1
1,2-Dichlorobenzene	ND		0.13	0.031	mg/Kg	☆	05/24/21 17:52	05/25/21 00:43	1
1,2-Dichloroethane	ND		0.13	0.021	mg/Kg	¢	05/24/21 17:52	05/25/21 00:43	1
1,2-Dichloropropane	ND		0.16	0.040	mg/Kg	☆	05/24/21 17:52	05/25/21 00:43	1
1,3,5-Trimethylbenzene	ND		0.13	0.043	mg/Kg	¢	05/24/21 17:52	05/25/21 00:43	1

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0.027

0.017 mg/Kg

0.040 mg/Kg

0.027 mg/Kg

0.032 mg/Kg

0.022 mg/Kg

0.012 mg/Kg

0.027 mg/Kg

0.013 mg/Kg

ND

ND

ND

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### Client Sample ID: SB13-1-0511 Date Collected: 05/11/21 14:35 Date Received: 05/13/21 10:00

# Lab Sample ID: 590-15130-13

Matrix: Solid Percent Solids: 77.3

Method: 8260D - Volatile O	rganic Compo	unds by G	iC/MS (Conti	nued)	11:0:4	<b>_</b>	Dremered	Anolymod	
Analyte Promohonzono		Quaimer	<b>KL</b>			<u> </u>	05/04/01 17:50	Analyzeu	
Bromoform			0.13	0.030	mg/Kg	۲۲ ۲	05/24/21 17:52	05/25/21 00:43	1
Bromonothana			0.27	0.025	mg/Kg	ж Ж	05/24/21 17:52	05/25/21 00:43	1
			0.07	0.044	mg/Kg		05/24/21 17:52	05/25/21 00:43	
			0.13	0.013	mg/Kg	ж Ж	05/24/21 17:52	05/25/21 00:43	1
			0.13	0.020	mg/Kg	ж Ж	05/24/21 17:52	05/25/21 00:43	1
Chlorodibromomothano			0.13	0.000	mg/Kg	۲۲ ۲	05/24/21 17:52	05/25/21 00:43	
			0.27	0.022	mg/Kg	·사 ·	05/24/21 17:52	05/25/21 00:43	1
Chloroform			0.27	0.075	mg/Kg	ж ж	05/24/21 17:52	05/25/21 00:43	1
Chloromothano			0.13	0.031	mg/Kg		05/24/21 17:52	05/25/21 00:43	
			0.07	0.000	mg/Kg	ж ж	05/24/21 17:52	05/25/21 00:43	1
			0.13	0.020	mg/Kg	¥ ×	05/24/21 17.52	05/25/21 00:43	1
			0.13	0.027	mg/Kg		05/24/21 17:52	05/25/21 00:43	
			0.13	0.030	mg/Kg	났	05/24/21 17:02	05/25/21 00:43	1
			0.13	0.003	mg/Kg	상	05/24/21 17:52	05/25/21 00:43	1
			0.13	0.037	mg/Kg	<del>بر</del> س	05/24/21 17.52	05/25/21 00.43	ا م
Ethylene Dibromide			0.13	0.022	mg/Kg	상	05/24/21 17:02	05/25/21 00:43	1
			0.13	0.040	mg/Kg	ᆉ	05/24/21 17.52	05/25/21 00.43	1
			0.13	0.022	mg/Kg		05/24/21 17:52	05/25/21 00:43	
			0.13	0.041	mg/Kg	¥ ×	05/24/21 17.52	05/25/21 00:43	1
Aethylene Chleride	ND		0.007	0.040	mg/Kg	14 	05/24/21 17.52	05/25/21 00:43	1
	ND		0.47	0.27	mg/Kg	بې بې د د د د .	05/24/21 17:52	05/25/21 00:43	
	ND		0.53	0.030	mg/kg	12 	05/24/21 17:52	05/25/21 00:43	1
	ND		0.27	0.037	mg/Kg	14 	05/24/21 17:52	05/25/21 00:43	1
	ND		0.13	0.037	mg/Kg		05/24/21 17:52	05/25/21 00:43	۱ ۸
I-Propyidenzene	ND		0.13	0.035	mg/Kg	Ф	05/24/21 17:52	05/25/21 00:43	1
-Xylene	ND		0.27	0.031	mg/Kg	:Q:	05/24/21 17:52	05/25/21 00:43	1
ec-Butyibenzene	ND		0.13	0.025	mg/Kg		05/24/21 17:52	05/25/21 00:43	
otyrene	ND		0.13	0.031	mg/Kg	:Q:	05/24/21 17:52	05/25/21 00:43	1
	ND		0.13	0.026	mg/Kg	Ç	05/24/21 17:52	05/25/21 00:43	1
	ND		0.053	0.023	mg/Kg	¢.	05/24/21 17:52	05/25/21 00:43	
oluene	ND		0.13	0.018	mg/Kg	æ	05/24/21 17:52	05/25/21 00:43	1
rans-1,2-Dichloroethene	ND		0.13	0.031	mg/Kg	æ	05/24/21 17:52	05/25/21 00:43	1
rans-1,3-Dichloropropene	ND		0.13	0.035	mg/Kg	¢.	05/24/21 17:52	05/25/21 00:43	1
richloroethene	ND		0.033	0.010	mg/Kg	¢	05/24/21 17:52	05/25/21 00:43	1
	ND		0.27	0.044	mg/Kg	¢	05/24/21 17:52	05/25/21 00:43	1
/inyl chloride	ND		0.080	0.027	mg/Kg	¢	05/24/21 17:52	05/25/21 00:43	1
urrogate	%Recoverv	Qualifier	Limits				Prepared	Analyzed	Dil Fac
,2-Dichloroethane-d4 (Surr)			75 - 129				05/24/21 17:52	05/25/21 00:43	1
-Bromofluorobenzene (Surr)	101		76 - 122				05/24/21 17:52	05/25/21 00:43	1
Dibromofluoromethane (Surr)	103		80 - 120				05/24/21 17:52	05/25/21 00:43	1
oluene-d8 (Surr)	97		80 - 120				05/24/21 17:52	05/25/21 00:43	1
Aethod: NWTPH-Gx - North	hwest - Volatile	Petroleu	m Products (	GC/MS)					
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Jasoline	ND		6.7	2.4	mg/Kg	☆	05/24/21 17:52	05/25/21 00:43	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
- 4-Bromofluorobenzene (Surr)			41 5 - 162				05/24/21 17:52	05/25/21 00:43	1

# Client Sample ID: SB13-1-0511 Date Collected: 05/11/21 14:35

### Lab Sample ID: 590-15130-13 Matrix: Solid

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
-Methylnaphthalene	ND		12	2.7	ug/Kg	— <u> </u>	05/24/21 11:33	05/24/21 23:38	1
-Methylnaphthalene	ND		12	3.8	ug/Kg	☆	05/24/21 11:33	05/24/21 23:38	1
cenaphthene	ND		12	3.1	ug/Kg	☆	05/24/21 11:33	05/24/21 23:38	1
cenaphthylene	ND		12	4.1	ug/Kg		05/24/21 11:33	05/24/21 23:38	1
Anthracene	ND		12	2.5	ug/Kg	¢	05/24/21 11:33	05/24/21 23:38	1
Benzo[a]anthracene	ND		12	2.6	ug/Kg	¢	05/24/21 11:33	05/24/21 23:38	1
Benzo[a]pyrene	ND		12	5.2	ug/Kg		05/24/21 11:33	05/24/21 23:38	1
enzo[b]fluoranthene	ND		12	4.3	ug/Kg	☆	05/24/21 11:33	05/24/21 23:38	1
senzo[g,h,i]perylene	ND		12	2.9	ug/Kg	¢	05/24/21 11:33	05/24/21 23:38	1
Senzo[k]fluoranthene	ND		12	3.1	ug/Kg		05/24/21 11:33	05/24/21 23:38	1
Chrysene	ND		12	1.9	ug/Kg	¢	05/24/21 11:33	05/24/21 23:38	1
) bibenz(a,h)anthracene	ND		12	3.5	ug/Kg	☆	05/24/21 11:33	05/24/21 23:38	1
luoranthene	ND		12	3.1	ug/Kg	₽	05/24/21 11:33	05/24/21 23:38	1
luorene	ND		12	2.7	ug/Kg	¢	05/24/21 11:33	05/24/21 23:38	1
ndeno[1,2,3-cd]pyrene	ND		12	3.6	ug/Kg	¢	05/24/21 11:33	05/24/21 23:38	1
laphthalene	ND		12	2.6	ug/Kg		05/24/21 11:33	05/24/21 23:38	1
'henanthrene	ND		12	4.4	ug/Kg	¢	05/24/21 11:33	05/24/21 23:38	1
Pyrene	ND		12	4.7	ug/Kg	¢	05/24/21 11:33	05/24/21 23:38	1
ırrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
Fluorobiphenyl (Surr)	82		47 - 120				05/24/21 11:33	05/24/21 23:38	1
itrobenzene-d5	26	S1-	33 - 120				05/24/21 11:33	05/24/21 23:38	1
Terphenyl-d14	104		74 - 120				05/24/21 11:33	05/24/21 23:38	1
lethod: 8011 - EDB, DBCP,	and 1,2,3-TCI	P (GC)							
nalyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Dibromoethane (EDB)	ND		0.098	0.043	ug/Kg	¢	05/25/21 11:10	05/25/21 23:39	1
ethod: 8082A - Polychlori	nated Binhen	us (PCBs)	hy Gas Chro	matogr	anhy				
nalyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
CB-1016	ND		13	2.8	ug/Kg	☆	05/25/21 10:45	05/25/21 16:55	1
CB-1221	ND		13	2.8	ug/Kg	₽	05/25/21 10:45	05/25/21 16:55	1
CB-1232	ND		13	2.8	ug/Kg	₽	05/25/21 10:45	05/25/21 16:55	1
CB-1242	ND		13	2.8	ug/Kg	₿	05/25/21 10:45	05/25/21 16:55	1
CB-1248	ND		13	2.8	ug/Kg	₽	05/25/21 10:45	05/25/21 16:55	1
CB-1254	ND		13	2.8	ug/Kg	₽	05/25/21 10:45	05/25/21 16:55	1
CB-1260	ND		13	2.8	ug/Kg	¢	05/25/21 10:45	05/25/21 16:55	1
urrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
etrachloro-m-xylene	85		22 - 131				05/25/21 10:45	05/25/21 16:55	1
CB Decachlorobiphenyl (Surr)	98		32 - 150				05/25/21 10:45	05/25/21 16:55	1
lethod: NWTPH-Dx - North	west - Semi-V	olatile Pet	roleum Prod	ucts (G0	C)				
nalyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Viocal Pango Organico (DPO)			12	5.2	malka	*	05/25/21 16.53	05/26/21 00.15	1

o-Terphenyl	84	50 - 150		05/25/21 16:53	05/26/21 00:15	1
Surrogate	%Recovery Qualifier	Limits		Prepared	Analyzed	Dil Fac
Residual Range Organics (RRO) (C25-C36)	11 J	31	6.2 mg/Kg	☆ 05/25/21 16:53	05/26/21 00:15	1
Diesel Range Organics (DRO)	ND	12	5.2 mg/Kg	☆ 05/25/21 16:53	05/26/21 00:15	1

### Client Sample ID: SB13-1-0511 Date Collected: 05/11/21 14:35 Date Received: 05/13/21 10:00

### Job ID: 590-15130-1

### Lab Sample ID: 590-15130-13 Matrix: Solid

Percent Solids: 77.3

Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fa
n-Triacontane-d62	76		50 - 150				05/25/21 16:53	05/26/21 00:15	
Method: 6020B - Metals (IC	P/MS)								
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	0.10	J	0.66	0.064	mg/Kg	¢	05/22/21 08:19	05/25/21 04:59	1(
Chromium	15		0.83	0.052	mg/Kg	¢	05/22/21 08:19	05/25/21 04:59	1(
Lead	6.2		0.41	0.040	mg/Kg	¢	05/22/21 08:19	05/25/21 04:59	1(
Nickel	13		0.41	0.16	mg/Kg	Ф	05/22/21 08:19	05/25/21 04:59	1(
Zinc	44		4.6	1.3	mg/Kg	¢	05/22/21 08:19	05/25/21 04:59	1(
lient Sample ID: SB15	-1-0511					La	ab Sample	ID: 590-151	130-14
ate Collected: 05/11/21 14:4	47							Matrix	c: Solic
ate Received: 05/13/21 10:0	00							Percent Solid	ls: 79.(
Method: 8260D - Volatile O	rganic Compo	unds by G	C/MS						
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fa
1,1,1,2-Tetrachloroethane	ND		0.11	0.021	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	-
1,1,1-Trichloroethane	ND		0.11	0.019	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	
1,1,2,2-Tetrachloroethane	ND		0.11	0.032	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	
1,1,2-Trichloroethane	ND		0.11	0.038	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	
1,1-Dichloroethane	ND		0.11	0.029	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	
1,1-Dichloroethene	ND		0.11	0.037	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	
1,1-Dichloropropene	ND		0.11	0.019	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	
1,2,3-Trichlorobenzene	ND		0.11	0.036	mg/Kg	☆	05/24/21 17:52	05/25/21 01:05	
1,2,3-Trichloropropane	ND		0.22	0.040	mg/Kg	☆	05/24/21 17:52	05/25/21 01:05	
1,2,4-Trichlorobenzene	ND		0.11	0.020	mg/Kg	☆	05/24/21 17:52	05/25/21 01:05	•
1,2,4-Trimethylbenzene	ND		0.11	0.025	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	
1,2-Dibromo-3-Chloropropane	ND		0.54	0.065	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	
1,2-Dichlorobenzene	ND		0.11	0.025	mg/Kg	☆	05/24/21 17:52	05/25/21 01:05	
1,2-Dichloroethane	ND		0.11	0.017	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	
1,2-Dichloropropane	ND		0.13	0.033	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	
1,3,5-Trimethylbenzene	ND		0.11	0.035	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	
1,3-Dichlorobenzene	ND		0.11	0.014	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	
1,3-Dichloropropane	ND		0.11	0.032	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	
1,4-Dichlorobenzene	ND		0.11	0.022	mg/Kg	₿	05/24/21 17:52	05/25/21 01:05	• • • • •
2,2-Dichloropropane	ND		0.11	0.026	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	
2-Chlorotoluene	ND		0.11	0.018	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	
4-Chlorotoluene	ND		0.11	0.0095	mg/Kg	☆	05/24/21 17:52	05/25/21 01:05	
4-Isopropyltoluene	ND		0.11	0.022	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	
Benzene	ND		0.022	0.011	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	
Bromobenzene	ND		0.11	0.024	mg/Kg		05/24/21 17:52	05/25/21 01:05	••••••
Bromoform	ND		0.22	0.021	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	
Bromomethane	ND		0.54	0.036	mg/Kg	☆	05/24/21 17:52	05/25/21 01:05	
Carbon tetrachloride	ND		0.11	0.012	mg/Kg		05/24/21 17:52	05/25/21 01:05	•••••
Chlorobenzene	ND		0.11	0.023	mg/Kg	☆	05/24/21 17:52	05/25/21 01:05	
Chlorobromomethane	ND		0.11	0.043	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	
Chlorodibromomethane	ND		0.22	0.018	mg/Kg		05/24/21 17:52	05/25/21 01:05	·····.
Chloroethane	ND		0.22	0.061	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	
Chloroform	ND		0 11	0 026	ma/Ka	÷.	05/24/21 17:52	05/25/21 01:05	
CHIOIOIOIIII			0	0.02.					

### Client Sample ID: SB15-1-0511 Date Collected: 05/11/21 14:47 Date Received: 05/13/21 10:00

# Lab Sample ID: 590-15130-14

Matrix: Solid Percent Solids: 79.0

Method: 8260D - Volatile O	rganic Compounds	by GC/MS (Conti	nued)					
Analyte	Result Qualit	ier RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND	0.11	0.023	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	1
cis-1,3-Dichloropropene	ND	0.11	0.022	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	1
Dibromomethane	ND	0.11	0.024	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	1
Dichlorobromomethane	ND	0.11	0.068	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	1
Dichlorodifluoromethane	ND	0.11	0.031	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	1
Ethylbenzene	ND	0.11	0.018	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	1
Ethylene Dibromide	ND	0.11	0.036	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	1
Hexachlorobutadiene	ND	0.11	0.018	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	1
sopropylbenzene	ND	0.11	0.034	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	1
Methyl tert-butyl ether	ND	0.054	0.033	mg/Kg	☆	05/24/21 17:52	05/25/21 01:05	1
Methylene Chloride	ND	0.38	0.22	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	1
n-Xylene & p-Xylene	ND	0.43	0.031	mg/Kg	☆	05/24/21 17:52	05/25/21 01:05	1
Naphthalene	ND	0.22	0.030	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	1
n-Butylbenzene	ND	0.11	0.030	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	1
N-Propylbenzene	ND	0.11	0.029	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	1
o-Xylene	ND	0.22	0.025	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	1
ec-Butylbenzene	ND	0.11	0.020	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	1
Styrene	ND	0.11	0.026	mg/Kg	₽	05/24/21 17:52	05/25/21 01:05	1
ert-Butylbenzene	ND	0.11	0.021	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	1
Tetrachloroethene	ND	0.043	0.019	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	1
Toluene	ND	0.11	0.014	mg/Kg	☆	05/24/21 17:52	05/25/21 01:05	1
rans-1,2-Dichloroethene	ND	0.11	0.025	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	1
rans-1,3-Dichloropropene	ND	0.11	0.029	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	1
Trichloroethene	ND	0.027	0.0083	mg/Kg	☆	05/24/21 17:52	05/25/21 01:05	1
Trichlorofluoromethane	ND	0.22	0.036	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	1
/inyl chloride	ND	0.065	0.022	mg/Kg	¢	05/24/21 17:52	05/25/21 01:05	1
Surrogate	%Recovery Quality	fier Limits				Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	100	75 - 129				05/24/21 17:52	05/25/21 01:05	1
1-Bromofluorobenzene (Surr)	112	76 - 122				05/24/21 17:52	05/25/21 01:05	1
Dibromofluoromethane (Surr)	101	80 - 120				05/24/21 17:52	05/25/21 01:05	1
Toluene-d8 (Surr)	101	80 - 120				05/24/21 17:52	05/25/21 01:05	1

#### Method: NWTPH-Gx - Northwest - Volatile Petroleum Products (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline	ND		5.4	2.0	mg/Kg	☆	05/24/21 17:52	05/25/21 01:05	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	112		41.5 - 162				05/24/21 17:52	05/25/21 01:05	1
Method: 8270E SIM - Semivol	latile Organi	c Compoi	unds (GC/MS	SIM)					
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1-Methylnaphthalene	ND		12	2.8	ug/Kg	☆	05/24/21 11:33	05/25/21 00:04	1
2-Methylnaphthalene	ND		12	3.9	ug/Kg	¢	05/24/21 11:33	05/25/21 00:04	1
Acenaphthene	ND		12	3.1	ug/Kg	¢	05/24/21 11:33	05/25/21 00:04	1
Acenaphthylene	ND		12	4.1	ug/Kg		05/24/21 11:33	05/25/21 00:04	1
Anthracene	ND		12	2.5	ug/Kg	₽	05/24/21 11:33	05/25/21 00:04	1
Benzo[a]anthracene	ND		12	2.7	ug/Kg	¢	05/24/21 11:33	05/25/21 00:04	1
Benzo[a]pyrene	ND		12	5.3	ug/Kg	₽	05/24/21 11:33	05/25/21 00:04	1
Benzo[b]fluoranthene	ND		12	4.4	ug/Kg	¢	05/24/21 11:33	05/25/21 00:04	1

### Client Sample ID: SB15-1-0511 Date Collected: 05/11/21 14:47 Date Received: 05/13/21 10:00

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### Lab Sample ID: 590-15130-14 Matrix: Solid

						、			
Method: 8270E SIM - Semivol		C Compou Qualifier	nas (GC/MS		Unit	) ח	Prepared	Analyzed	
Benzola h ilpervlene		quanter	12	2.9			05/24/21 11:33	05/25/21 00:04	
Benzo[k]fluoranthene	ND		12	3.1	ug/Kg		05/24/21 11:33	05/25/21 00:04	
Chrysene			12	19	ua/Ka	ň	05/24/21 11:33	05/25/21 00:04	
Dibenz(a h)anthracene			12	3.5	ug/Kg	~ .~	05/24/21 11:33	05/25/21 00:04	
Fluoranthene			12	3.0	ug/Kg	بر 	05/24/21 11:33	05/25/21 00:04	
Fluorene			12	2.1	ug/Kg	*	05/24/21 11:33	05/25/21 00:04	
			12	2.0	ug/Kg	*	05/24/21 11:33	05/25/21 00:04	
Nanhthalene			12	27	ug/Kg	بر 	05/24/21 11:33	05/25/21 00:04	
Phononthrono			12	2.1	ug/Kg	*	05/24/21 11:33	05/25/21 00:04	
Pirene			12	4.5	ug/Kg	¥	05/24/21 11.33	05/25/21 00.04	
Fylene	ND		12	4.7	ug/Ng	3 <sub>4</sub> 7	05/24/21 11.55	05/25/21 00.04	
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil F
2-Fluorobiphenyl (Surr)	92		47 - 120				05/24/21 11:33	05/25/21 00:04	
Nitrobenzene-d5	77		33 - 120				05/24/21 11:33	05/25/21 00:04	
p-Terphenyl-d14	112		74 - 120				05/24/21 11:33	05/25/21 00:04	
Method: 8011 - EDB, DBCP, a		P (GC) Qualifier	ы	MDI	Unit	Б	Bronarad	Apolyzod	
Allalyte	- Result	Quaimer	RL			<u> </u>			
Method: 8082A - Polychlorina	ated Bipheny	/Is (PCBs)	by Gas Chro	matogra	aphy	<b>D</b>	Branarad	Analyzad	
		Quaimer				<u> </u>	05/25/21 10:45	Allalyzeu	
			12	2.0	ug/Kg	¥	05/25/21 10:45	05/25/21 17.17	
PCB-1221			12	2.0	ug/Kg	Д	05/25/21 10:45	05/25/21 17:17	
FOB-1232			12	2.0	uy/Ky	<del>بر</del> ب	05/25/21 10.45	05/25/21 17.17	
PCB-1242	ND		12	2.0	ug/Kg	Ф	05/25/21 10:45	05/25/21 17:17	
PCB-1240	ND		12	2.0	ug/Kg	<del>.</del>	05/25/21 10:45	05/25/21 17:17	
PCB-1254	ND		12	2.0	ug/Kg		05/25/21 10:45	05/25/21 17:17	
PCB-1260	ND		12	2.6	ug/Kg	\$	05/25/21 10:45	05/25/21 17:17	
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil F
Tetrachloro-m-xylene	79		22 - 131				05/25/21 10:45	05/25/21 17:17	
DCB Decachlorobiphenyl (Surr)	82		32 - 150				05/25/21 10:45	05/25/21 17:17	
Method: NWTPH-Dx - Northw	ost - Somi-V	olatilo Pot	roleum Prod	ucts (GC	2)				
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analvzed	Dil F
Diesel Range Organics (DRO)	ND		12	5.1	mg/Kg	— <u>–</u>	05/25/21 16:53	05/26/21 00:36	
(C10-C25)					5.5				
Residual Range Organics (RRO)	9.5	J	31	6.1	mg/Kg	☆	05/25/21 16:53	05/26/21 00:36	
(C25-C36)									
	%Recoverv	Qualifier	Limits				Prepared	Analvzed	Dil F
Surrogate	///////////////////////////////////////							· · · · · · · · · · · · · · · · · · ·	
Surrogate o-Terphenyl	78		50 - 150				05/25/21 16:53	05/26/21 00:36	

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	0.093	J	0.77	0.074	mg/Kg	¢	05/22/21 08:19	05/25/21 05:45	10
Chromium	15		0.96	0.060	mg/Kg	¢	05/22/21 08:19	05/25/21 05:45	10
Lead	6.4		0.48	0.046	mg/Kg	¢	05/22/21 08:19	05/25/21 05:45	10
Nickel	13		0.48	0.19	mg/Kg	₽	05/22/21 08:19	05/25/21 05:45	10
Zinc	46		5.3	1.5	mg/Kg	₽	05/22/21 08:19	05/25/21 05:45	10

### Client Sample ID: SB18-1-0511 Date Collected: 05/11/21 16:18 Date Received: 05/13/21 10:00

# Lab Sample ID: 590-15130-15

Matrix: Solid Percent Solids: 97.5

Method: 8260D - Volatile Org	anic Compo	unds by GC	/MS			_				5
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac	J
1,1,1,2-Tetrachloroethane	ND		0.11	0.022	mg/Kg	Ċ.	05/24/21 17:52	05/25/21 01:27	1	
1,1,1-Trichloroethane	ND		0.11	0.020	mg/Kg	Ċ.	05/24/21 17:52	05/25/21 01:27	1	6
1,1,2,2-Tetrachloroethane	ND		0.11	0.033	mg/Kg	¢	05/24/21 17:52	05/25/21 01:27	1	
1,1,2-Trichloroethane	ND		0.11	0.040	mg/Kg	¢	05/24/21 17:52	05/25/21 01:27	1	
1,1-Dichloroethane	ND		0.11	0.030	mg/Kg	¢	05/24/21 17:52	05/25/21 01:27	1	
1,1-Dichloroethene	ND		0.11	0.038	mg/Kg	¢	05/24/21 17:52	05/25/21 01:27	1	8
1,1-Dichloropropene	ND		0.11	0.020	mg/Kg	Ċ.	05/24/21 17:52	05/25/21 01:27	1	
1,2,3-Trichlorobenzene	ND		0.11	0.038	mg/Kg	Ċ.	05/24/21 17:52	05/25/21 01:27	1	9
1,2,3-Trichloropropane	ND		0.23	0.041	mg/Kg	₿	05/24/21 17:52	05/25/21 01:27	1	
1,2,4-Trichlorobenzene	ND		0.11	0.021	mg/Kg	¢	05/24/21 17:52	05/25/21 01:27	1	
1,2,4-Trimethylbenzene	ND		0.11	0.026	mg/Kg	¢	05/24/21 17:52	05/25/21 01:27	1	
1,2-Dibromo-3-Chloropropane	ND		0.56	0.068	mg/Kg	¢	05/24/21 17:52	05/25/21 01:27	1	
1,2-Dichlorobenzene	ND		0.11	0.026	mg/Kg	¢	05/24/21 17:52	05/25/21 01:27	1	
1,2-Dichloroethane	ND		0.11	0.017	mg/Kg	☆	05/24/21 17:52	05/25/21 01:27	1	
1,2-Dichloropropane	ND		0.14	0.034	mg/Kg	☆	05/24/21 17:52	05/25/21 01:27	1	
1,3,5-Trimethylbenzene	ND		0.11	0.036	mg/Kg	¢	05/24/21 17:52	05/25/21 01:27	1	
1,3-Dichlorobenzene	ND		0.11	0.014	mg/Kg	¢	05/24/21 17:52	05/25/21 01:27	1	
1,3-Dichloropropane	ND		0.11	0.034	mg/Kg	¢	05/24/21 17:52	05/25/21 01:27	1	
1,4-Dichlorobenzene	ND		0.11	0.023	mg/Kg	☆	05/24/21 17:52	05/25/21 01:27	1	
2,2-Dichloropropane	ND		0.11	0.027	mg/Kg	☆	05/24/21 17:52	05/25/21 01:27	1	
2-Chlorotoluene	ND		0.11	0.018	mg/Kg	¢	05/24/21 17:52	05/25/21 01:27	1	
4-Chlorotoluene	ND		0.11	0.0098	mg/Kg	 ¢	05/24/21 17:52	05/25/21 01:27	1	
4-Isopropyltoluene	ND		0.11	0.023	mg/Kg	☆	05/24/21 17:52	05/25/21 01:27	1	
Benzene	ND		0.023	0.011	mg/Kg	¢	05/24/21 17:52	05/25/21 01:27	1	
Bromobenzene	ND		0.11	0.025	mg/Kg		05/24/21 17:52	05/25/21 01:27	1	
Bromoform	ND		0.23	0.022	mg/Kg	¢	05/24/21 17:52	05/25/21 01:27	1	
Bromomethane	ND		0.56	0.037	mg/Kg	¢	05/24/21 17:52	05/25/21 01:27	1	
Carbon tetrachloride	ND		0.11	0.012	ma/Ka		05/24/21 17:52	05/25/21 01:27	1	
Chlorobenzene	ND		0.11	0.023	ma/Ka	÷.	05/24/21 17:52	05/25/21 01:27	1	
Chlorobromomethane	ND		0.11	0.045	ma/Ka	÷.	05/24/21 17:52	05/25/21 01:27	1	
Chlorodibromomethane	ND		0.23	0.018	ma/Ka		05/24/21 17:52	05/25/21 01:27	1	
Chloroethane	ND		0.23	0.064	ma/Ka	÷.	05/24/21 17:52	05/25/21 01:27	1	
Chloroform	ND		0.11	0.027	ma/Ka	÷.	05/24/21 17:52	05/25/21 01:27	1	
Chloromethane	ND		0.56	0.047	ma/Ka		05/24/21 17:52	05/25/21 01:27		
cis-1.2-Dichloroethene	ND		0.11	0.023	ma/Ka	÷.	05/24/21 17:52	05/25/21 01:27	1	
cis-1.3-Dichloropropene	ND		0.11	0.023	ma/Ka	÷.	05/24/21 17:52	05/25/21 01:27	1	
Dibromomethane	ND		0.11	0.025	ma/Ka		05/24/21 17:52	05/25/21 01:27	1	
Dichlorobromomethane	ND		0.11	0.070	ma/Ka	÷.	05/24/21 17:52	05/25/21 01:27	1	
Dichlorodifluoromethane	ND		0.11	0.032	ma/Ka	÷	05/24/21 17:52	05/25/21 01:27	1	
Ethylbenzene	ND		0.11	0.018	ma/Ka		05/24/21 17:52	05/25/21 01:27	1	
Ethylene Dibromide	ND		0 11	0.038	ma/Ka	÷.	05/24/21 17:52	05/25/21 01.27	1	
Hexachlorobutadiene	ND		0.11	0.019	ma/Ka	÷	05/24/21 17:52	05/25/21 01:27	1	
Isopropylbenzene	ND		0 11	0.035	ma/Ka	 ¢	05/24/21 17:52	05/25/21 01.27	· · · · · · · · 1	
Methyl tert-butyl ether	ND		0.056	0 034	ma/Ka	Ť	05/24/21 17:52	05/25/21 01.27	1	
Methylene Chloride	ND		0 40	0.23	mg/Ka	÷.	05/24/21 17:52	05/25/21 01.27	1	
m-Xylene & p-Xylene			0.45	0.032	ma/Ka		05/24/21 17:52	05/25/21 01.27	· · · · · · · · · · · · · · · · · · ·	
Naphthalene			0.23	0.032	ma/Ka	ř	05/24/21 17:52	05/25/21 01:27	1	
n-Butylbenzene			0 11	0.031	ma/Ka	ř	05/24/21 17.52	05/25/21 01.27	1	
N-Propylbenzene	ND		0 11	0.030	ma/Ka		05/24/21 17:52	05/25/21 01.27	· · · · · · 1	
			<b>.</b>	0.000		~				

### Client Sample ID: SB18-1-0511 Date Collected: 05/11/21 16:18 Date Received: 05/13/21 10:00

# Lab Sample ID: 590-15130-15

Matrix: Solid Percent Solids: 97.5

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Method: 8260D - Volatile O	rganic Compo	unds by G	C/MS (Conti	nued)					
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
o-Xylene	ND		0.23	0.026	mg/Kg	¢	05/24/21 17:52	05/25/21 01:27	1
sec-Butylbenzene	ND		0.11	0.021	mg/Kg	₽	05/24/21 17:52	05/25/21 01:27	1
Styrene	ND		0.11	0.027	mg/Kg	₽	05/24/21 17:52	05/25/21 01:27	1
tert-Butylbenzene	ND		0.11	0.022	mg/Kg	₽	05/24/21 17:52	05/25/21 01:27	1
Tetrachloroethene	ND		0.045	0.020	mg/Kg	₽	05/24/21 17:52	05/25/21 01:27	1
Toluene	ND		0.11	0.015	mg/Kg	₽	05/24/21 17:52	05/25/21 01:27	1
trans-1,2-Dichloroethene	ND		0.11	0.026	mg/Kg	₽	05/24/21 17:52	05/25/21 01:27	1
trans-1,3-Dichloropropene	ND		0.11	0.030	mg/Kg	₽	05/24/21 17:52	05/25/21 01:27	1
Trichloroethene	ND		0.028	0.0086	mg/Kg	₽	05/24/21 17:52	05/25/21 01:27	1
Trichlorofluoromethane	ND		0.23	0.037	mg/Kg	₽	05/24/21 17:52	05/25/21 01:27	1
Vinyl chloride	ND		0.068	0.023	mg/Kg	¢	05/24/21 17:52	05/25/21 01:27	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	101		75 - 129				05/24/21 17:52	05/25/21 01:27	1
4-Bromofluorobenzene (Surr)	98		76 - 122				05/24/21 17:52	05/25/21 01:27	1
Dibromofluoromethane (Surr)	98		80 - 120				05/24/21 17:52	05/25/21 01:27	1
Toluene-d8 (Surr)	102		80 - 120				05/24/21 17:52	05/25/21 01:27	1

#### Method: NWTPH-Gx - Northwest - Volatile Petroleum Products (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline	ND		5.6	2.0	mg/Kg	\$	05/24/21 17:52	05/25/21 01:27	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	98		41.5 - 162				05/24/21 17:52	05/25/21 01:27	1

#### Method: 8270E SIM - Semivolatile Organic Compounds (GC/MS SIM)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1-Methylnaphthalene	ND		10	2.2	ug/Kg	⊉	05/24/21 11:33	05/25/21 00:30	1
2-Methylnaphthalene	ND		10	3.1	ug/Kg	¢	05/24/21 11:33	05/25/21 00:30	1
Acenaphthene	ND		10	2.5	ug/Kg	¢	05/24/21 11:33	05/25/21 00:30	1
Acenaphthylene	ND		10	3.3	ug/Kg	¢	05/24/21 11:33	05/25/21 00:30	1
Anthracene	ND		10	2.0	ug/Kg	¢	05/24/21 11:33	05/25/21 00:30	1
Benzo[a]anthracene	ND		10	2.1	ug/Kg	¢	05/24/21 11:33	05/25/21 00:30	1
Benzo[a]pyrene	ND		10	4.2	ug/Kg	¢	05/24/21 11:33	05/25/21 00:30	1
Benzo[b]fluoranthene	ND		10	3.5	ug/Kg	¢	05/24/21 11:33	05/25/21 00:30	1
Benzo[g,h,i]perylene	ND		10	2.3	ug/Kg	¢	05/24/21 11:33	05/25/21 00:30	1
Benzo[k]fluoranthene	ND		10	2.5	ug/Kg	¢	05/24/21 11:33	05/25/21 00:30	1
Chrysene	ND		10	1.5	ug/Kg	¢	05/24/21 11:33	05/25/21 00:30	1
Dibenz(a,h)anthracene	ND		10	2.8	ug/Kg	¢	05/24/21 11:33	05/25/21 00:30	1
Fluoranthene	ND		10	2.5	ug/Kg	¢	05/24/21 11:33	05/25/21 00:30	1
Fluorene	ND		10	2.2	ug/Kg	¢	05/24/21 11:33	05/25/21 00:30	1
Indeno[1,2,3-cd]pyrene	ND		10	3.0	ug/Kg	¢	05/24/21 11:33	05/25/21 00:30	1
Naphthalene	ND		10	2.1	ug/Kg	¢	05/24/21 11:33	05/25/21 00:30	1
Phenanthrene	ND		10	3.6	ug/Kg	¢	05/24/21 11:33	05/25/21 00:30	1
Pyrene	ND		10	3.8	ug/Kg	¢	05/24/21 11:33	05/25/21 00:30	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
2-Fluorobiphenyl (Surr)	86		47 - 120				05/24/21 11:33	05/25/21 00:30	1
Nitrobenzene-d5	66		33 - 120				05/24/21 11:33	05/25/21 00:30	1
p-Terphenyl-d14	115		74 - 120				05/24/21 11:33	05/25/21 00:30	1

Client: BGES, Inc.

Project/Site: Othello, WA

Client Sample ID: SB18-1-0511

Date Collected: 05/11/21 16:18

Job ID: 590-15130-1

# Lab Sample ID: 590-15130-15

Matrix: Solid 97.5

Date Received: 05/13/21 10:00	0							Percent Solid	ls: 97.5
Method: 8011 - EDB, DBCP,	and 1,2,3-TC	P (GC)							
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND	F1	0.080	0.035	ug/Kg	☆	05/25/21 11:10	05/26/21 00:28	1
Method: 8082A - Polychlorir	nated Biphen	yls (PCBs)	by Gas Chro	omatogr	aphy				
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	ND		10	2.2	ug/Kg	¢	05/25/21 10:45	05/25/21 17:38	1
PCB-1221	ND		10	2.2	ug/Kg	¢	05/25/21 10:45	05/25/21 17:38	1
PCB-1232	ND		10	2.2	ug/Kg	¢	05/25/21 10:45	05/25/21 17:38	1
PCB-1242	ND		10	2.2	ug/Kg	¢	05/25/21 10:45	05/25/21 17:38	1
PCB-1248	ND		10	2.2	ug/Kg	☆	05/25/21 10:45	05/25/21 17:38	1
PCB-1254	ND		10	2.2	ug/Kg	☆	05/25/21 10:45	05/25/21 17:38	1
PCB-1260	ND		10	2.2	ug/Kg	¢	05/25/21 10:45	05/25/21 17:38	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
Tetrachloro-m-xylene	94		22 - 131				05/25/21 10:45	05/25/21 17:38	1
DCB Decachlorobiphenyl (Surr)	104		32 - 150				05/25/21 10:45	05/25/21 17:38	1
Method: NWTPH-Dx - North	west - Semi-V	/olatile Pet	roleum Prod	ucts (GC	<b>C)</b>				
Analyte	Result	Qualifier	RL	MDL	, Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics (DRO)	ND		9.9	4.2	mg/Kg	<u>₩</u>	05/25/21 16:53	05/26/21 00:56	1
Residual Range Organics (RRO) (C25-C36)	ND		25	5.0	mg/Kg	¢	05/25/21 16:53	05/26/21 00:56	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
o-Terphenyl	80		50 - 150				05/25/21 16:53	05/26/21 00:56	1
n-Triacontane-d62	64		50 - 150				05/25/21 16:53	05/26/21 00:56	1
Method: 6020B - Metals (ICF	P/MS)								
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		0.63	0.060	mg/Kg	₽	05/22/21 08:19	05/25/21 05:52	10
Chromium	6.7		0.78	0.049	mg/Kg	₽	05/22/21 08:19	05/25/21 05:52	10
Lead	1.7		0.39	0.038	mg/Kg	¢	05/22/21 08:19	05/25/21 05:52	10
Nickel	4.8		0.39	0.15	mg/Kg	₽	05/22/21 08:19	05/25/21 05:52	10
Zinc	15		4.3	1.3	mg/Kg	₽	05/22/21 08:19	05/25/21 05:52	10
Client Sample ID: SB20-	1-0511					La	ab Sample	ID: 590-151	30-16
Date Collected: 05/11/21 16:5	0							Matrix	c: Solid
Date Received: 05/13/21 10:0	0							Percent Solic	ls: 92.4
Method: 8260D - Volatile Org	ganic Compo	unds by G	C/MS						
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	ND		0.12	0.022	mg/Kg	— <u> </u>	05/24/21 17:52	05/25/21 01:48	1
1,1,1-Trichloroethane	ND		0.12	0.020	mg/Kg	¢	05/24/21 17:52	05/25/21 01:48	1
1,1,2,2-Tetrachloroethane	ND		0.12	0.034	mg/Kg	¢	05/24/21 17:52	05/25/21 01:48	1
1 1 2-Trichloroethane	ND		0.12	0.041	ma/Ka		05/24/21 17.52	05/25/21 01:48	1

1, 1 1,1,2-Trichloroethane 1 ND 0.12 0.041 mg/Kg 05/24/21 17:52 05/25/21 01:48 1,1-Dichloroethane ND 0.12 0.031 mg/Kg 05/24/21 17:52 05/25/21 01:48
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 1 1,1-Dichloroethene ND 0.12 0.040 mg/Kg 05/24/21 17:52 05/25/21 01:48
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 1 1,1-Dichloropropene ND 0.020 mg/Kg 0.12 ¢ 05/24/21 17:52 05/25/21 01:48 1 ND 05/24/21 17:52 05/25/21 01:48 1,2,3-Trichlorobenzene 0.12 0.039 mg/Kg ά 1 ND 0.23 0.043 mg/Kg 1,2,3-Trichloropropane · 05/24/21 17:52 05/25/21 01:48 1 1,2,4-Trichlorobenzene ND 0.12 0.022 mg/Kg 05/24/21 17:52 05/25/21 01:48
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 05/ 1 1,2,4-Trimethylbenzene 0.027 mg/Kg · 05/24/21 17:52 05/25/21 01:48 ND 0.12 1

Eurofins TestAmerica, Spokane

6
#### Client Sample ID: SB20-1-0511 Date Collected: 05/11/21 16:50 Date Received: 05/13/21 10:00

## Lab Sample ID: 590-15130-16

Matrix: Solid Percent Solids: 92.4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analvzed	Dil Fac	5
1.2-Dibromo-3-Chloropropane	ND		0.58	0.070	ma/Ka	 #	05/24/21 17:52	05/25/21 01:48	1	
1.2-Dichlorobenzene	ND		0.12	0.027	ma/Ka		05/24/21 17:52	05/25/21 01:48	1	6
1.2-Dichloroethane	ND		0.12	0.018	ma/Ka	÷.	05/24/21 17:52	05/25/21 01:48	1	
1.2-Dichloropropane	ND		0.14	0.035	ma/Ka	÷	05/24/21 17:52	05/25/21 01:48	1	
1.3.5-Trimethylbenzene	ND		0.12	0.037	ma/Ka		05/24/21 17:52	05/25/21 01:48	1	
1 3-Dichlorobenzene	ND		0.12	0.015	ma/Ka	÷	05/24/21 17:52	05/25/21 01.48	1	0
1 3-Dichloropropane	ND		0.12	0.035	ma/Ka	-05-	05/24/21 17:52	05/25/21 01:48	1	Ō
1 4-Dichlorobenzene	ND		0.12	0.024	ma/Ka		05/24/21 17:52	05/25/21 01:48	· · · · · · · · · · · 1	
2 2-Dichloropropane	ND		0.12	0.028	ma/Ka	۰۰۰ ۲	05/24/21 17:52	05/25/21 01:48	1	9
2-Chlorotoluene	ND		0.12	0.019	ma/Ka	т Ю	05/24/21 17:52	05/25/21 01:48	1	
4-Chlorotoluene	ND		0.12	0.010	ma/Ka		05/24/21 17:52	05/25/21 01:48		
4-Isopronyltoluene	ND		0.12	0.010	ma/Ka	۰ بن	05/24/21 17:52	05/25/21 01:48	1	
Benzene	ND		0.023	0.024	ma/Ka	۰ بن	05/24/21 17:52	05/25/21 01:48	1	
Bromobenzene	ND		0.020	0.012	mg/Kg	······································	05/24/21 17:52	05/25/21 01:48		
Bromoform			0.12	0.020	mg/Kg	*	05/24/21 17:52	05/25/21 01:40	1	
Bromomethane			0.23	0.022	mg/Kg	~ ~	05/24/21 17:52	05/25/21 01:40	1	
			0.50	0.039	mg/Kg	·····	05/24/21 17:52	05/25/21 01:48		
Chlorobonzono			0.12	0.013	mg/Kg	ж ж	05/24/21 17:52	05/25/21 01:48	1	
Chlorobromomothono			0.12	0.024	mg/Kg	ж ж	05/24/21 17:52	05/25/21 01:40	1	
Chlorodibromemathane	ND		0.12	0.047	mg/Kg	<del>بر:</del> 	05/24/21 17:52	05/25/21 01:46	۱ ۰۰۰۰۰۰	
Chlorodibiomometriane	ND		0.23	0.019	mg/Kg	<del>بر</del> س	05/24/21 17:52	05/25/21 01:46	1	
	ND		0.23	0.000	mg/Kg	-Q:	05/24/21 17:52	05/25/21 01:48	1	
Chiorotorm	ND		0.12	0.027	mg/Kg	·····	05/24/21 17:52	05/25/21 01:48		
	ND		0.58	0.049	mg/Kg	-Q:	05/24/21 17:52	05/25/21 01:48	1	
cis-1,2-Dichloroethene	ND		0.12	0.024	mg/Kg	-Q-	05/24/21 17:52	05/25/21 01:48	1	
cis-1,3-Dicnioropropene	ND		0.12	0.024	mg/Kg	÷÷	05/24/21 17:52	05/25/21 01:48	1	
Dibromometnane	ND		0.12	0.026	mg/Kg	-\$ <del>.</del>	05/24/21 17:52	05/25/21 01:48	1	
	ND		0.12	0.072	mg/Kg	-Q-	05/24/21 17:52	05/25/21 01:48	1	
	ND		0.12	0.033	mg/Kg	÷÷	05/24/21 17:52	05/25/21 01:48	1	
Ethylbenzene	ND		0.12	0.019	mg/Kg	\$ <del>.</del>	05/24/21 17:52	05/25/21 01:48	1	
Ethylene Dibromide	ND		0.12	0.039	mg/Kg	-Q-	05/24/21 17:52	05/25/21 01:48	1	
Hexachlorobutadiene	ND		0.12	0.019	mg/Kg		05/24/21 17:52	05/25/21 01:48	1	
Isopropylbenzene	ND		0.12	0.036	mg/Kg	\$ <del>.</del>	05/24/21 17:52	05/25/21 01:48	1	
Methyl tert-butyl ether	ND		0.058	0.035	mg/Kg	₩.	05/24/21 17:52	05/25/21 01:48	1	
Methylene Chloride	ND		0.41	0.23	mg/Kg	¢.	05/24/21 17:52	05/25/21 01:48	1	
m-Xylene & p-Xylene	ND		0.47	0.033	mg/Kg	¢	05/24/21 17:52	05/25/21 01:48	1	
Naphthalene	ND		0.23	0.033	mg/Kg	\	05/24/21 17:52	05/25/21 01:48	1	
n-Butylbenzene	ND		0.12	0.032	mg/Kg		05/24/21 17:52	05/25/21 01:48	1	
N-Propylbenzene	ND		0.12	0.031	mg/Kg	¢	05/24/21 17:52	05/25/21 01:48	1	
o-Xylene	ND		0.23	0.027	mg/Kg	¢	05/24/21 17:52	05/25/21 01:48	1	
sec-Butylbenzene	ND		0.12	0.022	mg/Kg	☆	05/24/21 17:52	05/25/21 01:48	1	
Styrene	ND		0.12	0.028	mg/Kg	¢	05/24/21 17:52	05/25/21 01:48	1	
tert-Butylbenzene	ND		0.12	0.023	mg/Kg	¢	05/24/21 17:52	05/25/21 01:48	1	
Tetrachloroethene	ND		0.047	0.021	mg/Kg	¢	05/24/21 17:52	05/25/21 01:48	1	
Toluene	ND		0.12	0.016	mg/Kg	¢	05/24/21 17:52	05/25/21 01:48	1	
trans-1,2-Dichloroethene	ND		0.12	0.027	mg/Kg	¢	05/24/21 17:52	05/25/21 01:48	1	
trans-1,3-Dichloropropene	ND		0.12	0.031	mg/Kg	¢	05/24/21 17:52	05/25/21 01:48	1	
Trichloroethene	ND		0.029	0.0089	mg/Kg	¢	05/24/21 17:52	05/25/21 01:48	1	
Trichlorofluoromethane	ND		0.23	0.038	mg/Kg	¢	05/24/21 17:52	05/25/21 01:48	1	
Vinyl chloride	ND		0.070	0.024	mg/Kg	¢	05/24/21 17:52	05/25/21 01:48	1	

## **Client Sample Results**

Client: BGES, Inc. Project/Site: Othello, WA Job ID: 590-15130-1

Project/Site: Othello, WA									
Client Sample ID: SB20	-1-0511					la	h Sample	ID: 590-151	30-16
Date Collected: 05/11/21 16:	50							Matrix	' Solid
Date Received: 05/13/21 10:0	50 NO							Percent Solid	s 92 4
Date Received. 00/10/21 10.									3. 32.4
Surrogato	<sup>0</sup> / Pocovoru	Qualifiar	Limite				Proparad	Analyzod	Dil Eso
1 2-Dichloroethane-d4 (Surr)		Quaimer	75 - 129				05/24/21 17·52	05/25/21 01:48	1
4-Bromofluorobenzene (Surr)	102		76 - 122				05/24/21 17:52	05/25/21 01:48	1
Dibromofluoromethane (Surr)	100		80 - 120				05/24/21 17:52	05/25/21 01:48	1
Toluene-d8 (Surr)	102		80 - 120				05/24/21 17:52	05/25/21 01:48	
Method: NWTPH-Gx - North	nwest - Volatile	e Petroleu	m Products (	GC/MS)					
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline	ND		5.8	2.1	mg/Kg	☆	05/24/21 17:52	05/25/21 01:48	1
Surrogata	%Pacovary	Qualifior	l imite				Propared	Analyzod	Dil Eac
4-Bromofluorobenzene (Surr)		Quanner	41.5 - 162				05/24/21 17:52	05/25/21 01:48	1
	102		11.0 - 102				00/21/21 11:02	00/20/21 01.10	,
Method: 8270E SIM - Semiv	volatile Organi	c Compou	inds (GC/MS	SIM)					
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1-Methylnaphthalene	ND		10	2.3	ug/Kg	<u></u>	05/24/21 11:33	05/25/21 00:57	1
2-Methylnaphthalene	ND		10	3.2	ug/Kg	¢	05/24/21 11:33	05/25/21 00:57	1
Acenaphthene	ND		10	2.6	ug/Kg	¢	05/24/21 11:33	05/25/21 00:57	1
Acenaphthylene	ND		10	3.5	ug/Kg	₽	05/24/21 11:33	05/25/21 00:57	1
Anthracene	ND		10	2.1	ug/Kg	☆	05/24/21 11:33	05/25/21 00:57	1
Benzo[a]anthracene	ND		10	2.2	ug/Kg	¢	05/24/21 11:33	05/25/21 00:57	1
Benzo[a]pyrene	ND		10	4.4	ug/Kg	¢	05/24/21 11:33	05/25/21 00:57	1
Benzo[b]fluoranthene	ND		10	3.7	ug/Kg	¢	05/24/21 11:33	05/25/21 00:57	1
Benzo[g,h,i]perylene	ND		10	2.4	ug/Kg	¢	05/24/21 11:33	05/25/21 00:57	1
Benzo[k]fluoranthene	ND		10	2.6	ug/Kg	₽	05/24/21 11:33	05/25/21 00:57	1
Chrysene	ND		10	1.6	ug/Kg	¢	05/24/21 11:33	05/25/21 00:57	1
Dibenz(a,h)anthracene	ND		10	3.0	ug/Kg	¢	05/24/21 11:33	05/25/21 00:57	1
Fluoranthene	ND		10	2.6	ug/Kg	¢	05/24/21 11:33	05/25/21 00:57	1
Fluorene	ND		10	2.3	ug/Kg	¢	05/24/21 11:33	05/25/21 00:57	1
Indeno[1,2,3-cd]pyrene	ND		10	3.1	ug/Kg	¢	05/24/21 11:33	05/25/21 00:57	1
Naphthalene	ND		10	2.2	ug/Kg	¢	05/24/21 11:33	05/25/21 00:57	1
Phenanthrene	ND		10	3.8	ug/Kg	¢	05/24/21 11:33	05/25/21 00:57	1
Pyrene	ND		10	4.0	ug/Kg	¢	05/24/21 11:33	05/25/21 00:57	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
2-Fluorobiphenyl (Surr)	90		47 - 120				05/24/21 11:33	05/25/21 00:57	1
Nitrobenzene-d5	/3		33 - 120				05/24/21 11:33	05/25/21 00:57	1
p-Terpnenyi-a14	113		74 - 120				05/24/21 11:33	05/25/21 00:57	1
Method: 8011 - EDB, DBCP	and 1.2.3-TCI	P (GC)							
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	ND		0.084	0.037	ug/Kg	— <u> </u>	05/25/21 11:12	05/26/21 01:18	1
Method: 8082A - Polychlori	inated Bipheny	ls (PCBs)	by Gas Chro	omatogr	aphy				
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	ND		11	2.3	ug/Kg	¢	05/25/21 10:45	05/25/21 17:59	1
PCB-1221	ND		11	2.3	ug/Kg	¢	05/25/21 10:45	05/25/21 17:59	1
PCB-1232	ND		11	2.3	ug/Kg	☆	05/25/21 10:45	05/25/21 17:59	1
PCB-1242	ND		11	2.3	ug/Kg	¢	05/25/21 10:45	05/25/21 17:59	1
PCB-1248	ND		11	2.3	ug/Kg	¢	05/25/21 10:45	05/25/21 17:59	1
PCB-1254	ND		11	2.3	ug/Kg	¢	05/25/21 10:45	05/25/21 17:59	1
PCB-1260	ND		11	2.3	ug/Kg	¢	05/25/21 10:45	05/25/21 17:59	1

## **Client Sample Results**

Client: BGES, Inc. Project/Site: Of

1,2-Dichloroethane

1,2-Dichloropropane

1,3-Dichlorobenzene

1,3-Dichloropropane

1,4-Dichlorobenzene

2,2-Dichloropropane

2-Chlorotoluene

4-Chlorotoluene

Benzene

4-Isopropyltoluene

1,3,5-Trimethylbenzene

#### **Client Samp Date Collected Date Received**

Project/Site: Othello, WA									01001
Client Sample ID: SB20- Date Collected: 05/11/21 16:5	1-0511 0					La	ab Sample	ID: 590-151 Matrix	30-16
Jate Received: 05/13/21 10:00	U							Percent Solid	IS: 92.4
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
Tetrachloro-m-xylene			22 - 131				05/25/21 10:45	05/25/21 17:59	1
DCB Decachlorobiphenyl (Surr)	89		32 - 150				05/25/21 10:45	05/25/21 17:59	1
- Method: NWTPH-Dx - North	west - Semi-V	olatile Pet	roleum Prod	ucts (G	C)				
Analyte	Result	Qualifier	RL	MDL	Únit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics (DRO) (C10-C25)	ND		10	4.3	mg/Kg	¢	05/25/21 16:53	05/26/21 01:17	1
Residual Range Organics (RRO) (C25-C36)	ND		25	5.1	mg/Kg	¢	05/25/21 16:53	05/26/21 01:17	1
Surrogate	%Recoverv	Qualifier	Limits				Prepared	Analvzed	Dil Fa
o-Terphenyl			50 - 150				05/25/21 16:53	05/26/21 01:17	
n-Triacontane-d62	69		50 - 150				05/25/21 16:53	05/26/21 01:17	
Method: 6020B - Metals (ICF Analyte	P/MS) Result	Qualifier	RI	МП	Unit	п	Prenared	Analyzed	Dil Fa
Cadmium		duanner	0.61	0.059	ma/Ka		05/22/21 09:07	05/25/21 05:41	10
Chromium	14	•	0.76	0.048	ma/Ka	Ť	05/22/21 09:07	05/25/21 05:41	1(
Lead	6.8		0.38	0.037	ma/Ka	÷.	05/22/21 09:07	05/25/21 05:41	1(
Nickel	13		0.38	0.15	ma/Ka		05/22/21 09:07	05/25/21 05:41	1
Zinc	45		4.2	1.2	ma/Ka	¢	05/22/21 09:07	05/25/21 05:41	1(
Ilient Sample ID: SB20-2 ate Collected: 05/11/21 16:5 ate Received: 05/13/21 10:00 Method: 8260D - Volatile Org Analyte	2-0511 0 ganic Compo Result	unds by G Qualifier	C/MS RL	MDL	Unit	La	b Sample	ID: 590-151 Matrix Percent Solic Analyzed	30-17 :: Solid ls: 92.3 Dil Fac
1.1.1.2-Tetrachloroethane			0.13	0.024	ma/Ka	— <b>–</b>	05/24/21 17:52	05/25/21 02:31	
1,1,1-Trichloroethane	ND		0.13	0.022	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	
1,1,2,2-Tetrachloroethane	ND		0.13	0.037	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	
1,1,2-Trichloroethane	ND		0.13	0.045	mg/Kg		05/24/21 17:52	05/25/21 02:31	• • • • • •
1,1-Dichloroethane	ND		0.13	0.034	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	
1,1-Dichloroethene	ND		0.13	0.043	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	
1,1-Dichloropropene	ND		0.13	0.022	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	
1,2,3-Trichlorobenzene	ND		0.13	0.043	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	
1,2,3-Trichloropropane	ND		0.26	0.047	mg/Kg	₽	05/24/21 17:52	05/25/21 02:31	
1,2,4-Trichlorobenzene	ND		0.13	0.024	mg/Kg	₽	05/24/21 17:52	05/25/21 02:31	
1,2,4-Trimethylbenzene	ND		0.13	0.030	mg/Kg	₽	05/24/21 17:52	05/25/21 02:31	
1,2-Dibromo-3-Chloropropane	ND		0.64	0.077	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	
1,2-Dichlorobenzene	ND		0.13	0.030	mg/Kg	 X	05/24/21 17:52	05/25/21 02:31	•

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Client: BGES, Inc. Project/Site: Othello, WA

#### Client Sample ID: SB20-2-0511 Date Collected: 05/11/21 16:50 Date Received: 05/13/21 10:00

## Lab Sample ID: 590-15130-17

Matrix: Solid Percent Solids: 92.3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Bromobenzene	ND		0.13	0.028	mg/Kg	— <u> </u>	05/24/21 17:52	05/25/21 02:31	1
Bromoform	ND		0.26	0.024	mg/Kg		05/24/21 17:52	05/25/21 02:31	1
Bromomethane	ND		0.64	0.042	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
Carbon tetrachloride	ND		0.13	0.014	mg/Kg		05/24/21 17:52	05/25/21 02:31	1
Chlorobenzene	ND		0.13	0.026	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
Chlorobromomethane	ND		0.13	0.051	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
Chlorodibromomethane	ND		0.26	0.021	mg/Kg		05/24/21 17:52	05/25/21 02:31	1
Chloroethane	ND		0.26	0.072	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
Chloroform	ND		0.13	0.030	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
Chloromethane	ND		0.64	0.053	mg/Kg		05/24/21 17:52	05/25/21 02:31	1
cis-1,2-Dichloroethene	ND		0.13	0.027	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
cis-1,3-Dichloropropene	ND		0.13	0.026	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
Dibromomethane	ND		0.13	0.028	mg/Kg		05/24/21 17:52	05/25/21 02:31	1
Dichlorobromomethane	ND		0.13	0.079	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
Dichlorodifluoromethane	ND		0.13	0.036	mg/Kg	₽	05/24/21 17:52	05/25/21 02:31	1
Ethylbenzene	ND		0.13	0.021	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
Ethylene Dibromide	ND		0.13	0.043	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
Hexachlorobutadiene	ND		0.13	0.021	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
sopropylbenzene	ND		0.13	0.039	mg/Kg	 ¢	05/24/21 17:52	05/25/21 02:31	1
Methyl tert-butyl ether	ND		0.064	0.038	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
Methylene Chloride	ND		0.45	0.26	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
m-Xylene & p-Xylene	ND		0.51	0.037	mg/Kg	 ¢	05/24/21 17:52	05/25/21 02:31	1
Naphthalene	0.042	J	0.26	0.036	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
n-Butylbenzene	ND		0.13	0.035	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
N-Propylbenzene	ND		0.13	0.034	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
o-Xylene	ND		0.26	0.029	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
sec-Butylbenzene	ND		0.13	0.024	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
Styrene	ND		0.13	0.030	mg/Kg		05/24/21 17:52	05/25/21 02:31	1
ert-Butylbenzene	ND		0.13	0.025	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
Tetrachloroethene	ND		0.051	0.022	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
Toluene	ND		0.13	0.017	mg/Kg		05/24/21 17:52	05/25/21 02:31	1
trans-1,2-Dichloroethene	ND		0.13	0.029	mg/Kg	₽	05/24/21 17:52	05/25/21 02:31	1
trans-1,3-Dichloropropene	ND		0.13	0.034	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
Trichloroethene	ND		0.032	0.0097	mg/Kg		05/24/21 17:52	05/25/21 02:31	1
Trichlorofluoromethane	ND		0.26	0.042	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
Vinyl chloride	ND		0.077	0.026	mg/Kg	¢	05/24/21 17:52	05/25/21 02:31	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)			75 - 129				05/24/21 17:52	05/25/21 02:31	1
4-Bromofluorobenzene (Surr)	106		76 - 122				05/24/21 17:52	05/25/21 02:31	1
Dibromofluoromethane (Surr)	102		80 - 120				05/24/21 17:52	05/25/21 02:31	1
Toluene-d8 (Surr)	103		80 - 120				05/24/21 17:52	05/25/21 02:31	1
Method: NWTPH-Gx - Nort	hwest - Volatile	e Petroleu	m Products	(GC/MS)					
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline	ND		6.4	2.3	mg/Kg	<u></u>	05/24/21 17:52	05/25/21 02:31	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)			41.5 - 162				05/24/21 17:52	05/25/21 02:31	1

# Client Sample ID: SB20-2-0511 Date Collected: 05/11/21 16:50

#### Lab Sample ID: 590-15130-17 Matrix: Solid

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Methylnaphthalene	ND		10	2.3	ug/Kg	\$	05/24/21 11:33	05/25/21 01:23	1
-Methylnaphthalene	ND		10	3.2	ug/Kg	¢	05/24/21 11:33	05/25/21 01:23	1
cenaphthene	ND		10	2.6	ug/Kg	¢	05/24/21 11:33	05/25/21 01:23	1
cenaphthylene	ND		10	3.4	ug/Kg	₽	05/24/21 11:33	05/25/21 01:23	1
nthracene	ND		10	2.0	ug/Kg	₽	05/24/21 11:33	05/25/21 01:23	1
enzo[a]anthracene	ND		10	2.2	ug/Kg	₽	05/24/21 11:33	05/25/21 01:23	1
enzo[a]pyrene	ND		10	4.3	ug/Kg	₽	05/24/21 11:33	05/25/21 01:23	1
enzo[b]fluoranthene	ND		10	3.6	ug/Kg	₽	05/24/21 11:33	05/25/21 01:23	1
enzo[g,h,i]perylene	ND		10	2.4	ug/Kg	₽	05/24/21 11:33	05/25/21 01:23	1
enzo[k]fluoranthene	ND		10	2.5	ug/Kg	₽	05/24/21 11:33	05/25/21 01:23	1
hrysene	ND		10	1.5	ug/Kg	₽	05/24/21 11:33	05/25/21 01:23	1
ibenz(a,h)anthracene	ND		10	2.9	ug/Kg	₽	05/24/21 11:33	05/25/21 01:23	1
luoranthene	ND		10	2.5	ug/Kg	☆	05/24/21 11:33	05/25/21 01:23	1
luorene	ND		10	2.3	ug/Kg	₽	05/24/21 11:33	05/25/21 01:23	1
ideno[1,2,3-cd]pyrene	ND		10	3.0	ug/Kg	₽	05/24/21 11:33	05/25/21 01:23	1
aphthalene	ND		10	2.2	ug/Kg	₽	05/24/21 11:33	05/25/21 01:23	1
henanthrene	ND		10	3.7	ug/Kg	₽	05/24/21 11:33	05/25/21 01:23	1
yrene	ND		10	3.9	ug/Kg	₽	05/24/21 11:33	05/25/21 01:23	1
ırrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
Fluorobiphenyl (Surr)	93		47 - 120				05/24/21 11:33	05/25/21 01:23	1
itrobenzene-d5	75		33 - 120				05/24/21 11:33	05/25/21 01:23	1
Terphenyl-d14	112		74 - 120				05/24/21 11:33	05/25/21 01:23	1
lethod: 8011 - EDB, DBCP,	, and 1,2,3-TC	P (GC)				_			
nalyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
ethod: 8082A - Polychlori	nated Bipheny	/Is (PCBs)	by Gas Chro	omatogr	aphy	~	Dremented	Archined	
		Quaimer	KL			<u> </u>		Allalyzeu	
2B-1010	םא חא		11	2.J 2.2	ug/Kg	بر بر	05/25/21 10.45	05/25/21 10.20	1
○D-1221 ○R-1939	םאי חא		11	2.J 2.J	ug/Kg	·사	05/25/21 10.45	05/25/21 10.20	1
∩B-1202			11 11	∠.J 2.2	ug/Kg	بر 	05/25/21 10.45	05/25/21 18.20	· · · · · · · · · · · · · · · · · · ·
			11	2.0	ug/rty	ᆉ	05/25/21 10.45	05/25/21 10.20	1
CB-1240 CR-1254			11	∠.3 2.2	ug/Kg	났 쓰	05/25/21 10.43	05/25/21 10.20	1
CD-1234	ND		11	2.3	ug/Kg ug/Kg	÷	05/25/21 10:45	05/25/21 18:20	1
CB-1260									
CB-1260	%Recoverv	Qualifier	Limits				Prepared	Analvzed	Dil Fac
CB-1260 urrogate trachloro-m-xvlene	%Recovery	Qualifier	Limits				Prepared 05/25/21 10:45	Analyzed 05/25/21 18:20	Dil Fac

Analyte	Result	Qualifier	RL	MDL	, Unit	D	Prepared	Analyzed	Dil Fac
Diesel Range Organics (DRO) (C10-C25)	ND		11	4.4	mg/Kg	¢	05/25/21 16:53	05/26/21 01:38	1
Residual Range Organics (RRO) (C25-C36)	ND		26	5.3	mg/Kg	¢	05/25/21 16:53	05/26/21 01:38	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
o-Terphenvl	82		50 - 150				05/25/21 16:53	05/26/21 01:38	1

## **Client Sample Results**

Surrogate

Analyte

Nickel Zinc

Cadmium

Chromium Lead

n-Triacontane-d62

#### Client Sample ID: SB20-2-0511 Date Collected: 05/11/21 16:50 Date Received: 05/13/21 10:00

Method: 6020B - Metals (ICP/MS)

Method: NWTPH-Dx - Northwest - Sem

#### Job ID: 590-15130-1

#### Lab Sample ID: 590-15130-17 Matrix: Solid

Percent Solids: 92.3

Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fa
67		50 - 150				05/25/21 16:53	05/26/21 01:38	
Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
0.10	J	0.72	0.070	mg/Kg	¢	05/22/21 08:19	05/25/21 05:49	10
15		0.90	0.057	mg/Kg	¢	05/22/21 08:19	05/25/21 05:49	10
7.0		0.45	0.043	mg/Kg	₽	05/22/21 08:19	05/25/21 05:49	10
14		0.45	0.17	mg/Kg	¢	05/22/21 08:19	05/25/21 05:49	10
48		5.0	1.5	mg/Kg	₽	05/22/21 08:19	05/25/21 05:49	10
					La	ib Sample	ID: 590-151	30-10
		0/110			La	ib Sample	ID: 590-151 Matrix	SO-18
Compo Result	unds by G Qualifier	C/MS RL	MDL	Unit	La	Prepared	ID: 590-151 Matrix Analyzed	Dil Fac
Compo Result ND	unds by G Qualifier	C/MS 	<b>MDL</b> 0.019	Unit mg/Kg	D	Prepared 05/24/21 17:52	<b>Analyzed</b> 05/25/21 02:53	Solic Dil Fac
Compo Result ND ND	unds by G Qualifier	C/MS 	<b>MDL</b> 0.019 0.017	Unit mg/Kg mg/Kg	<u>D</u>	Prepared 05/24/21 17:52 05/24/21 17:52	Analyzed 05/25/21 02:53 05/25/21 02:53	Dil Fac
Compo Result ND ND ND	unds by G Qualifier	C/MS 	<b>MDL</b> 0.019 0.017 0.029	Unit mg/Kg mg/Kg mg/Kg	<u>D</u>	Prepared 05/24/21 17:52 05/24/21 17:52 05/24/21 17:52	Analyzed 05/25/21 02:53 05/25/21 02:53 05/25/21 02:53	Dil Fa
Compo Result ND ND ND ND	unds by G Qualifier	C/MS 	MDL 0.019 0.017 0.029 0.035	Unit mg/Kg mg/Kg mg/Kg mg/Kg	D	Prepared 05/24/21 17:52 05/24/21 17:52 05/24/21 17:52 05/24/21 17:52	Analyzed 05/25/21 02:53 05/25/21 02:53 05/25/21 02:53 05/25/21 02:53	Dil Fac
Compo Result ND ND ND ND ND	unds by G Qualifier	C/MS 	MDL 0.019 0.017 0.029 0.035 0.026	Unit mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg	D	Prepared 05/24/21 17:52 05/24/21 17:52 05/24/21 17:52 05/24/21 17:52 05/24/21 17:52	Analyzed 05/25/21 02:53 05/25/21 02:53 05/25/21 02:53 05/25/21 02:53 05/25/21 02:53 05/25/21 02:53	Dil Fa
Compo Result ND ND ND ND ND ND	unds by G Qualifier	C/MS RL 0.098 0.098 0.098 0.098 0.098 0.098 0.098	MDL 0.019 0.017 0.029 0.035 0.026 0.034	Unit mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg	<u>D</u>	Prepared 05/24/21 17:52 05/24/21 17:52 05/24/21 17:52 05/24/21 17:52 05/24/21 17:52 05/24/21 17:52	Analyzed 05/25/21 02:53 05/25/21 02:53 05/25/21 02:53 05/25/21 02:53 05/25/21 02:53 05/25/21 02:53 05/25/21 02:53	Dil Fa
Compo Result ND ND ND ND ND ND ND	unds by G Qualifier	C/MS RL 0.098 0.098 0.098 0.098 0.098 0.098 0.098 0.098	MDL 0.019 0.029 0.035 0.026 0.034 0.017	Unit mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg mg/Kg	D	Prepared 05/24/21 17:52 05/24/21 17:52 05/24/21 17:52 05/24/21 17:52 05/24/21 17:52 05/24/21 17:52 05/24/21 17:52	Analyzed 05/25/21 02:53 05/25/21 02:53 05/25/21 02:53 05/25/21 02:53 05/25/21 02:53 05/25/21 02:53 05/25/21 02:53 05/25/21 02:53	Dil Fa

Client	Sample	ID:	Trip	Blank	
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#### Date Collected: 05/11/21 00:00 Date Received: 05/13/21 10:00

Analyte	Result Qualifier	RL	MDL	Unit	D	Prepared	Analyzed
1,1,1,2-Tetrachloroethane	ND	0.098	0.019	mg/Kg		05/24/21 17:52	05/25/21 02:53
1,1,1-Trichloroethane	ND	0.098	0.017	mg/Kg		05/24/21 17:52	05/25/21 02:53
1,1,2,2-Tetrachloroethane	ND	0.098	0.029	mg/Kg		05/24/21 17:52	05/25/21 02:53
1,1,2-Trichloroethane	ND	0.098	0.035	mg/Kg		05/24/21 17:52	05/25/21 02:53
1,1-Dichloroethane	ND	0.098	0.026	mg/Kg		05/24/21 17:52	05/25/21 02:53
1,1-Dichloroethene	ND	0.098	0.034	mg/Kg		05/24/21 17:52	05/25/21 02:53
1,1-Dichloropropene	ND	0.098	0.017	mg/Kg		05/24/21 17:52	05/25/21 02:53
1,2,3-Trichlorobenzene	ND	0.098	0.033	mg/Kg		05/24/21 17:52	05/25/21 02:53
1,2,3-Trichloropropane	ND	0.20	0.036	mg/Kg		05/24/21 17:52	05/25/21 02:53
1,2,4-Trichlorobenzene	ND	0.098	0.018	mg/Kg		05/24/21 17:52	05/25/21 02:53
1,2,4-Trimethylbenzene	ND	0.098	0.023	mg/Kg		05/24/21 17:52	05/25/21 02:53
1,2-Dibromo-3-Chloropropane	ND	0.49	0.059	mg/Kg		05/24/21 17:52	05/25/21 02:53
1,2-Dichlorobenzene	ND	0.098	0.023	mg/Kg		05/24/21 17:52	05/25/21 02:53
1,2-Dichloroethane	ND	0.098	0.015	mg/Kg		05/24/21 17:52	05/25/21 02:53
1,2-Dichloropropane	ND	0.12	0.030	mg/Kg		05/24/21 17:52	05/25/21 02:53
1,3,5-Trimethylbenzene	ND	0.098	0.032	mg/Kg		05/24/21 17:52	05/25/21 02:53
1,3-Dichlorobenzene	ND	0.098	0.012	mg/Kg		05/24/21 17:52	05/25/21 02:53
1,3-Dichloropropane	ND	0.098	0.029	mg/Kg		05/24/21 17:52	05/25/21 02:53
1,4-Dichlorobenzene	ND	0.098	0.020	mg/Kg		05/24/21 17:52	05/25/21 02:53
2,2-Dichloropropane	ND	0.098	0.024	mg/Kg		05/24/21 17:52	05/25/21 02:53
2-Chlorotoluene	ND	0.098	0.016	mg/Kg		05/24/21 17:52	05/25/21 02:53
4-Chlorotoluene	ND	0.098	0.0086	mg/Kg		05/24/21 17:52	05/25/21 02:53
4-Isopropyltoluene	ND	0.098	0.020	mg/Kg		05/24/21 17:52	05/25/21 02:53
Benzene	ND	0.020	0.0098	mg/Kg		05/24/21 17:52	05/25/21 02:53
Bromobenzene	ND	0.098	0.022	mg/Kg		05/24/21 17:52	05/25/21 02:53
Bromoform	ND	0.20	0.019	mg/Kg		05/24/21 17:52	05/25/21 02:53
Bromomethane	ND	0.49	0.033	mg/Kg		05/24/21 17:52	05/25/21 02:53
Carbon tetrachloride	ND	0.098	0.011	mg/Kg		05/24/21 17:52	05/25/21 02:53
Chlorobenzene	ND	0.098	0.020	mg/Kg		05/24/21 17:52	05/25/21 02:53
Chlorobromomethane	ND	0.098	0.039	mg/Kg		05/24/21 17:52	05/25/21 02:53
Chlorodibromomethane	ND	0.20	0.016	mg/Kg		05/24/21 17:52	05/25/21 02:53
Chloroethane	ND	0.20	0.056	mg/Kg		05/24/21 17:52	05/25/21 02:53
Chloroform	ND	0.098	0.023	mg/Kg		05/24/21 17:52	05/25/21 02:53
Chloromethane	ND	0.49	0.041	mg/Kg		05/24/21 17:52	05/25/21 02:53

Eurotins TestAmerica, Spokane

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#### Client Sample ID: Trip Blank Date Collected: 05/11/21 00:00 Date Received: 05/13/21 10:00

### Lab Sample ID: 590-15130-18 Matrix: Solid

atrix: Solid

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.098	0.020	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
cis-1,3-Dichloropropene	ND		0.098	0.020	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
Dibromomethane	ND		0.098	0.022	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
Dichlorobromomethane	ND		0.098	0.061	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
Dichlorodifluoromethane	ND		0.098	0.028	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
Ethylbenzene	ND		0.098	0.016	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
Ethylene Dibromide	ND		0.098	0.033	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
lexachlorobutadiene	ND		0.098	0.016	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
sopropylbenzene	ND		0.098	0.030	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
/lethyl tert-butyl ether	ND		0.049	0.030	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
lethylene Chloride	ND		0.34	0.20	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
n-Xylene & p-Xylene	ND		0.39	0.028	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
Japhthalene	ND		0.20	0.028	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
-Butylbenzene	ND		0.098	0.027	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
I-Propylbenzene	ND		0.098	0.026	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
-Xylene	ND		0.20	0.023	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
ec-Butylbenzene	ND		0.098	0.018	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
Styrene	ND		0.098	0.023	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
ert-Butylbenzene	ND		0.098	0.019	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
etrachloroethene	ND		0.039	0.017	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
oluene	ND		0.098	0.013	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
ans-1,2-Dichloroethene	ND		0.098	0.023	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
ans-1,3-Dichloropropene	ND		0.098	0.026	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
richloroethene	ND		0.025	0.0075	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
Trichlorofluoromethane	ND		0.20	0.032	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
/inyl chloride	ND		0.059	0.020	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
urrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
,2-Dichloroethane-d4 (Surr)	103		75 - 129				05/24/21 17:52	05/25/21 02:53	1
-Bromofluorobenzene (Surr)	103		76 - 122				05/24/21 17:52	05/25/21 02:53	1
Dibromofluoromethane (Surr)	100		80 - 120				05/24/21 17:52	05/25/21 02:53	1
Toluene-d8 (Surr)	103		80 - 120				05/24/21 17:52	05/25/21 02:53	1

## Method: NWTPH-Gx - Northwest - Volatile Petroleum Products (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline	ND		4.9	1.8	mg/Kg		05/24/21 17:52	05/25/21 02:53	1
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)	103		41.5 - 162				05/24/21 17:52	05/25/21 02:53	1

## Method: 8260D - Volatile Organic Compounds by GC/MS

MB MB

#### Lab Sample ID: MB 590-31722/1-A Matrix: Solid Analysis Batch: 31717

#### **Client Sample ID: Method Blank** Prep Type: Total/NA Prep Batch: 31722

Blaı tal/N 3172	nk IA 22	3
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	1	
	1	
	1	
	1	8
	1	
	1	6
	1	2
	1	
	1	

Analyte Resu	It Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane N		0.10	0.019	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
1,1,1-Trichloroethane N	C	0.10	0.017	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
1,1,2,2-Tetrachloroethane N	C	0.10	0.029	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
1,1,2-Trichloroethane N	Σ	0.10	0.035	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
1,1-Dichloroethane N	C	0.10	0.026	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
1,1-Dichloroethene N	C	0.10	0.034	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
1,1-Dichloropropene N		0.10	0.017	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
1,2,3-Trichlorobenzene N	C	0.10	0.033	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
1,2,3-Trichloropropane N	C	0.20	0.037	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
1,2,4-Trichlorobenzene N		0.10	0.019	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
1,2,4-Trimethylbenzene N	C	0.10	0.023	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
1,2-Dibromo-3-Chloropropane N	C	0.50	0.060	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
1,2-Dichlorobenzene N		0.10	0.023	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
1,2-Dichloroethane N	C	0.10	0.015	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
1,2-Dichloropropane N	C	0.12	0.030	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
1,3,5-Trimethylbenzene N		0.10	0.032	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
1,3-Dichlorobenzene N	C	0.10	0.013	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
1,3-Dichloropropane N	C	0.10	0.030	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
1,4-Dichlorobenzene N		0.10	0.021	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
2.2-Dichloropropane N	C	0.10	0.024	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
2-Chlorotoluene N	כ	0.10	0.016	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
4-Chlorotoluene N	- - -	0.10	0.0087	ma/Ka		05/24/21 17:51	05/24/21 19:43	
4-Isopropyltoluene N	- ר	0.10	0 020	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
Benzene N	2	0.020	0.010	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
Bromobenzene N	- 	0.10	0.022	ma/Ka		05/24/21 17:51	05/24/21 19:43	
Bromoform N	- ר	0.20	0.019	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
Bromomethane	2	0.50	0.033	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
Carbon tetrachloride N	- 	0 10	0.011	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
Chlorobenzene N	2	0.10	0.021	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
Chlorobromomethane N	- C	0.10	0.040	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
Chlorodibromomethane N		0.20	0.016	ma/Ka		05/24/21 17:51	05/24/21 19:43	
Chloroethane N	-	0.20	0.056	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
Chloroform N	- ר	0.10	0 024	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
Chloromethane N	-	0.50	0.042	ma/Ka		05/24/21 17:51	05/24/21 19:43	
cis-1.2-Dichloroethene N	- C	0.10	0.021	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
cis-1.3-Dichloropropene N	- C	0.10	0.020	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
Dibromomethane N	- 	0.10	0.022	ma/Ka		05/24/21 17:51	05/24/21 19:43	
Dichlorobromomethane N	- ר	0.10	0.062	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
Dichlorodifluoromethane N	2	0.10	0.028	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
Ethylbenzene N	- 	0.10	0.016	ma/Ka		05/24/21 17:51	05/24/21 19:43	
Ethylene Dibromide N	- ר	0.10	0.034	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
Hexachlorobutadiene N	C	0.10	0.016	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
Isopropylbenzene N		0.10	0.031	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
Methyl tert-butyl ether N	C	0.050	0.030	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
Methylene Chloride N	C	0.35	0.20	mg/Ka		05/24/21 17:51	05/24/21 19:43	1
m-Xvlene & p-Xvlene N		0.40	0.029	ma/Ka		05/24/21 17:51	05/24/21 19:43	1
Naphthalene N	C	0.20	0.028	mg/Ka		05/24/21 17:51	05/24/21 19:43	1
n-Butylbenzene N	ר	0.10	0.028	ma/Ka		05/24/21 17:51	05/24/21 19:43	1

## Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

#### Lab Sample ID: MB 590-31722/1-A Matrix: Solid

# **Client Sample ID: Metho** Prep Type:

Job ID: 590-15130-1

e ID: Method Blank	
Prep Type: Total/NA	
Pron Batch: 31722	
Thep Daten. 51722	

Analysis Batch: 31717

-	MB	МВ							
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
N-Propylbenzene	ND		0.10	0.026	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
o-Xylene	ND		0.20	0.023	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
sec-Butylbenzene	ND		0.10	0.019	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
Styrene	ND		0.10	0.024	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
tert-Butylbenzene	ND		0.10	0.020	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
Tetrachloroethene	ND		0.040	0.018	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
Toluene	ND		0.10	0.013	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
trans-1,2-Dichloroethene	ND		0.10	0.023	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
trans-1,3-Dichloropropene	ND		0.10	0.026	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
Trichloroethene	ND		0.025	0.0076	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
Trichlorofluoromethane	ND		0.20	0.033	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
Vinyl chloride	ND		0.060	0.020	mg/Kg		05/24/21 17:51	05/24/21 19:43	1
	МВ	МВ							
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	100		75 - 129				05/24/21 17:51	05/24/21 19:43	1
4-Bromofluorobenzene (Surr)	104		76 - 122				05/24/21 17:51	05/24/21 19:43	1
Dibromofluoromethane (Surr)	101		80 - 120				05/24/21 17:51	05/24/21 19:43	1
Toluene-d8 (Surr)	100		80 - 120				05/24/21 17:51	05/24/21 19:43	1
Lab Sample ID: LCS 590-3 Matrix: Solid	1722/2-A					Clien	t Sample ID:	Lab Control S Prep Type: To	Sample otal/NA

Analysis Batch: 31717

Analysis Batch: 31717							Prep Batch: 31722
	Spike	LCS	LCS				%Rec.
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits
1,1,1,2-Tetrachloroethane	0.500	0.509		mg/Kg		102	80 - 128
1,1,1-Trichloroethane	0.500	0.529		mg/Kg		106	80 - 130
1,1,2,2-Tetrachloroethane	0.500	0.459		mg/Kg		92	75 - 128
1,1,2-Trichloroethane	0.500	0.487		mg/Kg		97	80 - 125
1,1-Dichloroethane	0.500	0.512		mg/Kg		102	80 - 129
1,1-Dichloroethene	0.500	0.524		mg/Kg		105	73 - 135
1,1-Dichloropropene	0.500	0.531		mg/Kg		106	78 - 132
1,2,3-Trichlorobenzene	0.500	0.491		mg/Kg		98	66 - 130
1,2,3-Trichloropropane	0.500	0.485		mg/Kg		97	67 - 131
1,2,4-Trichlorobenzene	0.500	0.463		mg/Kg		93	79 - 126
1,2,4-Trimethylbenzene	0.500	0.511		mg/Kg		102	76 - 132
1,2-Dibromo-3-Chloropropane	0.500	0.492	J	mg/Kg		98	49 - 139
1,2-Dichlorobenzene	0.500	0.504		mg/Kg		101	80 - 124
1,2-Dichloroethane	0.500	0.499		mg/Kg		100	80 - 129
1,2-Dichloropropane	0.500	0.515		mg/Kg		103	75 - 121
1,3,5-Trimethylbenzene	0.500	0.502		mg/Kg		100	76 - 133
1,3-Dichlorobenzene	0.500	0.499		mg/Kg		100	80 - 123
1,3-Dichloropropane	0.500	0.503		mg/Kg		101	76 - 125
1,4-Dichlorobenzene	0.500	0.513		mg/Kg		103	80 - 125
2,2-Dichloropropane	0.500	0.542		mg/Kg		108	80 - 138
2-Chlorotoluene	0.500	0.525		mg/Kg		105	77 - 135
4-Chlorotoluene	0.500	0.515		mg/Kg		103	77 - 133
4-Isopropyltoluene	0.500	0.512		mg/Kg		102	80 - 130
Benzene	0.500	0.514		mg/Kg		103	76 - 129

Prep Type: Total/NA

**Client Sample ID: Lab Control Sample** 

## Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

101

#### Lab Sample ID: LCS 590-31722/2-A **Matrix: Solid**

#### Analysis Batch: 31717

Toluene-d8 (Surr)

Analysis Batch: 31717									Prep B	atch: 31722
-			Spike	LCS	LCS				%Rec.	
Analyte			Added	Result	Qualifier	Unit	D	%Rec	Limits	
Bromobenzene			0.500	0.565		mg/Kg		113	75 - 129	
Bromoform			0.500	0.458		mg/Kg		92	72 - 133	
Bromomethane			0.500	0.568		mg/Kg		114	56 - 138	
Carbon tetrachloride			0.500	0.579		mg/Kg		116	72 - 138	
Chlorobenzene			0.500	0.527		mg/Kg		105	80 - 129	
Chlorobromomethane			0.500	0.488		mg/Kg		98	75 - 135	
Chlorodibromomethane			0.500	0.497		mg/Kg		99	78 - 127	
Chloroethane			0.500	0.589		mg/Kg		118	50 - 142	
Chloroform			0.500	0.510		mg/Kg		102	80 - 130	
Chloromethane			0.500	0.474	J	mg/Kg		95	63 - 120	
cis-1,2-Dichloroethene			0.500	0.497		mg/Kg		99	80 - 124	
cis-1,3-Dichloropropene			0.500	0.488		mg/Kg		98	80 - 126	
Dibromomethane			0.500	0.483		mg/Kg		97	80 - 123	
Dichlorobromomethane			0.500	0.490		mg/Kg		98	80 - 128	
Dichlorodifluoromethane			0.500	0.363		mg/Kg		73	34 - 120	
Ethylbenzene			0.500	0.534		mg/Kg		107	77 - 126	
Ethylene Dibromide			0.500	0.502		mg/Kg		100	80 - 121	
Hexachlorobutadiene			0.500	0.536		mg/Kg		107	80 - 136	
lsopropylbenzene			0.500	0.519		mg/Kg		104	78 - 139	
Methyl tert-butyl ether			0.500	0.494		mg/Kg		99	80 - 123	
Methylene Chloride			0.500	0.541		mg/Kg		108	30 - 150	
m-Xylene & p-Xylene			0.500	0.507		mg/Kg		101	78 - 130	
Naphthalene			0.500	0.422		mg/Kg		84	53 - 144	
n-Butylbenzene			0.500	0.493		mg/Kg		99	80 - 131	
N-Propylbenzene			0.500	0.527		mg/Kg		105	77 - 131	
o-Xylene			0.500	0.510		mg/Kg		102	77 - 129	
sec-Butylbenzene			0.500	0.527		mg/Kg		105	76 - 130	
Styrene			0.500	0.463		mg/Kg		93	80 - 128	
tert-Butylbenzene			0.500	0.521		mg/Kg		104	76 - 130	
Tetrachloroethene			0.500	0.541		mg/Kg		108	77 - 134	
Toluene			0.500	0.524		mg/Kg		105	77 - 131	
trans-1,2-Dichloroethene			0.500	0.516		mg/Kg		103	80 - 126	
trans-1,3-Dichloropropene			0.500	0.501		mg/Kg		100	80 - 124	
Trichloroethene			0.500	0.499		mg/Kg		100	79 - 133	
Trichlorofluoromethane			0.500	0.541		mg/Kg		108	64 - 143	
Vinyl chloride			0.500	0.481		mg/Kg		96	66 - 129	
	LCS	LCS								
Surrogate	%Recoverv	Qualifier	Limits							
1,2-Dichloroethane-d4 (Surr)	96		75 - 129							
4-Bromofluorobenzene (Surr)	102		76 - 122							
Dibromofluoromethane (Surr)	98		80 - 120							

80 - 120

RL

0.30

0.20

0.20

MDL Unit

0.038 ug/L

0.025 ug/L

0.056 ug/L

D

Prepared

### Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

MB MB

ND

ND

ND

Result Qualifier

#### Lab Sample ID: MB 580-356713/7 Matrix: Water

Analysis Batch: 356713

1,1,1,2-Tetrachloroethane

1,1,2,2-Tetrachloroethane

1,1,1-Trichloroethane

Analyte

<b>Client Sample ID: Method Blank</b>
Prep Type: Total/NA

Analyzed

05/17/21 12:01

05/17/21 12:01

05/17/21 12:01

Job ID: 590-15130-1

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1 1	8
1	9
1	
1	
1	

12

1,1,2-Trichloroethane	ND	0.20	0.070	ug/L	05/17/21 12:01	1
1,1-Dichloroethane	ND	0.20	0.025	ug/L	05/17/21 12:01	1
1,1-Dichloroethene	ND	0.20	0.035	ug/L	05/17/21 12:01	1
1,1-Dichloropropene	ND	0.20	0.036	ug/L	05/17/21 12:01	1
1,2,3-Trichlorobenzene	ND	0.50	0.15	ug/L	05/17/21 12:01	1
1,2,3-Trichloropropane	ND	0.20	0.050	ug/L	05/17/21 12:01	1
1,2,4-Trichlorobenzene	ND	0.50	0.17	ug/L	05/17/21 12:01	1
1,2,4-Trimethylbenzene	ND	0.30	0.072	ug/L	05/17/21 12:01	1
1,2-Dibromo-3-Chloropropane	ND	2.0	0.44	ug/L	05/17/21 12:01	1
1,2-Dichlorobenzene	ND	0.30	0.038	ug/L	05/17/21 12:01	1
1,2-Dichloroethane	ND	0.20	0.043	ug/L	05/17/21 12:01	1
1,2-Dichloropropane	ND	0.20	0.060	ug/L	05/17/21 12:01	1
1,3,5-Trimethylbenzene	ND	0.50	0.15	ug/L	05/17/21 12:01	1
1,3-Dichlorobenzene	ND	0.30	0.050	ug/L	05/17/21 12:01	1
1,3-Dichloropropane	ND	0.20	0.025	ug/L	05/17/21 12:01	1
1,4-Dichlorobenzene	ND	0.30	0.050	ug/L	05/17/21 12:01	1
2,2-Dichloropropane	ND	0.50	0.060	ug/L	05/17/21 12:01	1
2-Chlorotoluene	ND	0.50	0.12	ug/L	05/17/21 12:01	1
4-Chlorotoluene	ND	0.30	0.050	ug/L	05/17/21 12:01	1
4-Isopropyltoluene	ND	0.50	0.15	ug/L	05/17/21 12:01	1
Benzene	ND	0.20	0.030	ug/L	05/17/21 12:01	1
Bromobenzene	ND	0.20	0.038	ug/L	05/17/21 12:01	1
Bromoform	ND	0.50	0.16	ug/L	05/17/21 12:01	1
Bromomethane	ND	0.50	0.062	ug/L	05/17/21 12:01	1
Carbon tetrachloride	ND	0.20	0.025	ug/L	05/17/21 12:01	1
Chlorobenzene	ND	0.20	0.025	ug/L	05/17/21 12:01	1
Chlorobromomethane	ND	0.20	0.025	ug/L	05/17/21 12:01	1
Chlorodibromomethane	ND	0.20	0.055	ug/L	05/17/21 12:01	1
Chloroethane	ND	0.50	0.096	ug/L	05/17/21 12:01	1
Chloroform	ND	0.20	0.030	ug/L	05/17/21 12:01	1
Chloromethane	ND	0.50	0.068	ug/L	05/17/21 12:01	1
cis-1,2-Dichloroethene	ND	0.20	0.055	ug/L	05/17/21 12:01	1
cis-1,3-Dichloropropene	ND	0.20	0.090	ug/L	05/17/21 12:01	1
Dibromomethane	ND	0.20	0.062	ug/L	05/17/21 12:01	1
Dichlorobromomethane	ND	0.20	0.060	ug/L	05/17/21 12:01	1
Dichlorodifluoromethane	ND	0.40	0.13	ug/L	05/17/21 12:01	1
Ethylbenzene	ND	0.20	0.030	ug/L	05/17/21 12:01	1
Ethylene Dibromide	ND	0.10	0.025	ug/L	05/17/21 12:01	1
Hexachlorobutadiene	ND	0.50	0.067	ug/L	05/17/21 12:01	1
Isopropylbenzene	ND	1.0	0.19	ug/L	05/17/21 12:01	1
Methyl tert-butyl ether	ND	0.30	0.070	ug/L	05/17/21 12:01	1
Methylene Chloride	ND	5.0	1.2	ug/L	05/17/21 12:01	1
m-Xylene & p-Xylene	ND	0.50	0.12	ug/L	05/17/21 12:01	1
Naphthalene	ND	1.0	0.22	ug/L	05/17/21 12:01	1
n-Butylbenzene	ND	1.0	0.23	ug/L	05/17/21 12:01	1

RL

0.30

0.50

1.0

1.0

0.50

0.50

0.20

0.20

0.20

0.20

0.50

0.020

Limits

80 - 120

80 - 120

80 - 120

80 - 120

MDL Unit

0.091 ug/L

0.15 ug/L

0.17 ug/L

0.19 ug/L

0.26 ug/L

0.084 ug/L

0.050 ug/L

0.033 ug/L

0.092 ug/L

0.066 ug/L

0.043 ug/L

0.013 ug/L

D

Prepared

Prepared

## Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

MB MB

Qualifier

Result

ND

101

102

104

100

%Recovery

MB MB

Qualifier

#### Lab Sample ID: MB 580-356713/7 Matrix: Water

## Analysis Batch: 356713

Analyte

o-Xylene

Styrene

Toluene

N-Propylbenzene

sec-Butylbenzene

tert-Butylbenzene

Tetrachloroethene

Trichloroethene

Vinyl chloride

Surrogate

Toluene-d8 (Surr)

trans-1,2-Dichloroethene

Trichlorofluoromethane

trans-1,3-Dichloropropene

1,2-Dichloroethane-d4 (Surr)

4-Bromofluorobenzene (Surr)

Dibromofluoromethane (Surr)

Client Sa	mple ID: I	Method	Blanl
	Prep T	ype: To	tal/N/

Analyzed

05/17/21 12:01

05/17/21 12:01

05/17/21 12:01

05/17/21 12:01

05/17/21 12:01

05/17/21 12:01

05/17/21 12:01

05/17/21 12:01

05/17/21 12:01

05/17/21 12:01

05/17/21 12:01

05/17/21 12:01

Analyzed

05/17/21 12:01

05/17/21 12:01

05/17/21 12:01

05/17/21 12:01

Prep Type: Total/NA

**Client Sample ID: Lab Control Sample** 

Job ID: 590-15130-1

Blank tal/NA Dil Fac

1

1

1

1

1

1

1

1

1

1

1

1

1

1

Dil Fac

#### Lab Sample ID: LCS 580-356713/4 Matrix: Water Analysis Batch: 356713

	Spike	LCS	LCS				%Rec.	
Analyte 1,1,1,2-Tetrachloroethane 1,1,1-Trichloroethane 1,1,2,2-Tetrachloroethane 1,1,2-Trichloroethane 1,1-Dichloroethane 1,1-Dichloroethane 1,1-Dichloroptopene 1,2,3-Trichlorobenzene 1,2,4-Trichlorobenzene	Added	Result	Qualifier	Unit	D	%Rec	Limits	
1,1,1,2-Tetrachloroethane	5.00	5.43		ug/L		109	79 - 127	
1,1,1-Trichloroethane	5.00	5.73		ug/L		115	79_121	
1,1,2,2-Tetrachloroethane	5.00	5.11		ug/L		102	76 - 123	
1,1,2-Trichloroethane	5.00	5.37		ug/L		107	80 - 127	
1,1-Dichloroethane	5.00	5.27		ug/L		105	74 - 120	
1,1-Dichloroethene	5.00	6.30	*+	ug/L		126	79 - 120	
1,1-Dichloropropene	5.00	5.52		ug/L		110	72 - 120	
1,2,3-Trichlorobenzene	5.00	5.16		ug/L		103	75 - 128	
1,2,3-Trichloropropane	5.00	4.97		ug/L		99	75 - 127	
1,2,4-Trichlorobenzene	5.00	5.14		ug/L		103	79_121	
1,2,4-Trimethylbenzene	5.00	4.86		ug/L		97	78 - 127	
1,2-Dibromo-3-Chloropropane	5.00	6.10		ug/L		122	73 - 123	
1,2-Dichlorobenzene	5.00	4.90		ug/L		98	80 - 129	
1,2-Dichloroethane	5.00	5.15		ug/L		103	74 - 120	
1,2-Dichloropropane	5.00	5.05		ug/L		101	80 - 130	
1,3,5-Trimethylbenzene	5.00	5.10		ug/L		102	80 - 129	
1,3-Dichlorobenzene	5.00	4.87		ug/L		97	80 - 130	
1,3-Dichloropropane	5.00	5.01		ug/L		100	80 - 123	
1,4-Dichlorobenzene	5.00	4.85		ug/L		97	80 - 129	
2,2-Dichloropropane	5.00	5.71		ug/L		114	67 - 133	
2-Chlorotoluene	5.00	5.06		ug/L		101	80 - 120	
4-Chlorotoluene	5.00	5.08		ug/L		102	80 - 124	
4-Isopropyltoluene	5.00	5.27		ug/L		105	78 - 132	
Benzene	5.00	5.39		ug/L		108	73 - 120	

## Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

## Lab Sample ID: LCS 580-356713/4

#### Matrix: Water Analysis Batch: 356713

Dibromofluoromethane (Surr)

Toluene-d8 (Surr)

104

99

			Spike	LCS	LCS				%Rec.
Analyte			Added	Result	Qualifier	Unit	D	%Rec	Limits
Bromobenzene			5.00	5.15		ug/L		103	80 - 130
Bromoform			5.00	6.83	*+	ug/L		137	69 - 125
Bromomethane			5.00	5.35		ug/L		107	68 - 131
Carbon tetrachloride			5.00	6.38	*+	ug/L		128	78 - 120
Chlorobenzene			5.00	4.85		ug/L		97	80 - 123
Chlorobromomethane			5.00	5.50		ug/L		110	79 - 131
Chlorodibromomethane			5.00	6.40	*+	ug/L		128	76 - 126
Chloroethane			5.00	5.41		ug/L		108	70 - 135
Chloroform			5.00	5.08		ug/L		102	80 - 130
Chloromethane			5.00	5.42		ug/L		108	66 - 134
cis-1,2-Dichloroethene			5.00	5.56		ug/L		111	72 - 130
cis-1,3-Dichloropropene			5.00	5.67		ug/L		113	77 - 120
Dibromomethane			5.00	5.62		ug/L		112	65 - 141
Dichlorobromomethane			5.00	6.16	*+	ug/L		123	74 - 120
Dichlorodifluoromethane			5.00	7.32	*+	ug/L		146	58 - 126
Ethylbenzene			5.00	4.87		ug/L		97	80 - 130
Ethylene Dibromide			5.00	5.16		ug/L		103	80 - 126
Hexachlorobutadiene			5.00	5.33		ug/L		107	78 - 120
Isopropylbenzene			5.00	5.44		ug/L		109	83 - 131
Methyl tert-butyl ether			5.00	5.43		ug/L		109	73 - 125
Methylene Chloride			5.00	5.30		ug/L		106	68 - 134
m-Xylene & p-Xylene			5.00	5.18		ug/L		104	86 - 130
Naphthalene			5.00	5.19		ug/L		104	69 - 123
n-Butylbenzene			5.00	5.15		ug/L		103	80 - 127
N-Propylbenzene			5.00	4.99		ug/L		100	77 - 142
o-Xylene			5.00	5.11		ug/L		102	80 - 133
sec-Butylbenzene			5.00	5.22		ug/L		104	84 - 132
Styrene			5.00	5.31		ug/L		106	74 - 136
tert-Butylbenzene			5.00	5.22		ug/L		104	77 - 129
Tetrachloroethene			5.00	5.26		ug/L		105	75 - 131
Toluene			5.00	4.92		ug/L		98	80 - 126
trans-1,2-Dichloroethene			5.00	5.64		ug/L		113	63 - 133
trans-1,3-Dichloropropene			5.00	5.39		ug/L		108	71 - 128
Trichloroethene			5.00	5.09		ug/L		102	72 - 136
Trichlorofluoromethane			5.00	6.18	*+	ug/L		124	75 - 120
Vinyl chloride			5.00	6.29		ug/L		126	69 - 128
	LCS	LCS							
Surrogate	%Recovery	Qualifier	Limits						
1,2-Dichloroethane-d4 (Surr)	101		80 - 120						
4-Bromofluorobenzene (Surr)	103		80 - 120						

6/21/2021 (Rev. 1)

80 - 120

80 - 120

Prep Type: Total/NA

**Client Sample ID: Lab Control Sample** 

Prep Type: Total/NA

Client Sample ID: Lab Control Sample Dup

## Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

## Lab Sample ID: LCSD 580-356713/5

#### Matrix: Water Analysis Batch: 356713

	Spike	LCSD	LCSD				%Rec.		RPD
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits	RPD	Limit
1,1,1,2-Tetrachloroethane	5.00	5.35		ug/L		107	79 - 127	1	11
1,1,1-Trichloroethane	5.00	5.61		ug/L		112	79_121	2	14
1,1,2,2-Tetrachloroethane	5.00	4.79		ug/L		96	76 - 123	7	10
1,1,2-Trichloroethane	5.00	5.05		ug/L		101	80 - 127	6	10
1,1-Dichloroethane	5.00	5.12		ug/L		102	74 - 120	3	10
1,1-Dichloroethene	5.00	5.94		ug/L		119	79 - 120	6	17
1,1-Dichloropropene	5.00	5.26		ug/L		105	72 - 120	5	10
1,2,3-Trichlorobenzene	5.00	5.16		ug/L		103	75 - 128	0	20
1,2,3-Trichloropropane	5.00	4.62		ug/L		92	75 - 127	7	12
1,2,4-Trichlorobenzene	5.00	5.16		ug/L		103	79_121	0	20
1,2,4-Trimethylbenzene	5.00	4.91		ug/L		98	78 - 127	1	10
1,2-Dibromo-3-Chloropropane	5.00	5.97		ug/L		119	73 - 123	2	16
1,2-Dichlorobenzene	5.00	4.86		ug/L		97	80 - 129	1	10
1,2-Dichloroethane	5.00	4.88		ug/L		98	74 - 120	6	10
1,2-Dichloropropane	5.00	4.72		ug/L		94	80 - 130	7	14
1,3,5-Trimethylbenzene	5.00	5.20		ug/L		104	80 - 129	2	10
1,3-Dichlorobenzene	5.00	4.83		ug/L		97	80 - 130	1	12
1,3-Dichloropropane	5.00	4.71		ug/L		94	80 - 123	6	19
1,4-Dichlorobenzene	5.00	4.77		ug/L		95	80 - 129	2	11
2,2-Dichloropropane	5.00	5.99		ug/L		120	67 - 133	5	16
2-Chlorotoluene	5.00	5.08		ug/L		102	80 - 120	0	10
4-Chlorotoluene	5.00	5.01		ug/L		100	80 - 124	1	10
4-Isopropyltoluene	5.00	5.35		ug/L		107	78 - 132	1	14
Benzene	5.00	5.19		ug/L		104	73 - 120	4	10
Bromobenzene	5.00	5.03		ug/L		101	80 - 130	2	11
Bromoform	5.00	6.42	*+	ug/L		128	69 - 125	6	10
Bromomethane	5.00	5.26		ug/L		105	68 - 131	2	18
Carbon tetrachloride	5.00	6.28	*+	ug/L		126	78 - 120	2	10
Chlorobenzene	5.00	4.68		ug/L		94	80 - 123	4	12
Chlorobromomethane	5.00	5.30		ug/L		106	79_131	4	10
Chlorodibromomethane	5.00	6.07		ug/L		121	76 - 126	5	10
Chloroethane	5.00	5.09		ug/L		102	70 - 135	6	20
Chloroform	5.00	4.94		ug/L		99	80 - 130	3	10
Chloromethane	5.00	5.10		ug/L		102	66 - 134	6	16
cis-1,2-Dichloroethene	5.00	5.43		ug/L		109	72 - 130	2	10
cis-1,3-Dichloropropene	5.00	5.41		ug/L		108	77 - 120	5	10
Dibromomethane	5.00	5.17		ug/L		103	65 - 141	8	10
Dichlorobromomethane	5.00	5.67		ug/L		113	74 - 120	8	10
Dichlorodifluoromethane	5.00	6.89	*+	ug/L		138	58 - 126	6	16
Ethylbenzene	5.00	4.77		ug/L		95	80 - 130	2	10
Ethylene Dibromide	5.00	4.84		ug/L		97	80 - 126	6	11
Hexachlorobutadiene	5.00	5.47		ug/L		109	78 - 120	3	15
Isopropylbenzene	5.00	5.44		ug/L		109	83 - 131	0	10
Methyl tert-butyl ether	5.00	5.12		ug/L		102	73 - 125	6	12
Methylene Chloride	5.00	5.15		ug/L		103	68 - 134	3	18
m-Xylene & p-Xylene	5.00	5.08		ug/L		102	86 - 130	2	10
Naphthalene	5.00	5.07		ug/L		101	69 - 123	2	20
n-Butylbenzene	5.00	5.24		ug/L		105	80 - 127	2	10

Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

#### Job ID: 590-15130-1

Prep Type: Total/NA

Client Sample ID: Lab Control Sample Dup

# 1 2 3 4 5 6 7

# Lab Sample ID: LCSD 580-356713/5

#### Matrix: Water Analysis Batch: 356713

-	Spike	LCSD	LCSD				%Rec.		RPD
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits	RPD	Limit
N-Propylbenzene		4.96		ug/L		99	77 - 142	1	20
o-Xylene	5.00	5.06		ug/L		101	80 - 133	1	10
sec-Butylbenzene	5.00	5.28		ug/L		106	84 - 132	1	10
Styrene	5.00	5.14		ug/L		103	74 - 136	3	10
tert-Butylbenzene	5.00	5.23		ug/L		105	77 - 129	0	10
Tetrachloroethene	5.00	5.10		ug/L		102	75 - 131	3	20
Toluene	5.00	4.78		ug/L		96	80 - 126	3	20
trans-1,2-Dichloroethene	5.00	5.51		ug/L		110	63 - 133	2	17
trans-1,3-Dichloropropene	5.00	5.08		ug/L		102	71 - 128	6	16
Trichloroethene	5.00	4.87		ug/L		97	72 - 136	5	14
Trichlorofluoromethane	5.00	5.98		ug/L		120	75 - 120	3	13
Vinyl chloride	5.00	5.90		ug/L		118	69 - 128	6	21

	LUSD	LUSD	
Surrogate	%Recovery	Qualifier	Limits
1,2-Dichloroethane-d4 (Surr)	97		80 - 120
4-Bromofluorobenzene (Surr)	102		80 - 120
Dibromofluoromethane (Surr)	105		80 - 120
Toluene-d8 (Surr)	100		80 - 120

#### Lab Sample ID: MB 580-356791/7 Matrix: Water Analysis Batch: 356791

#### Client Sample ID: Method Blank Prep Type: Total/NA

**Client Sample ID: Lab Control Sample** 

Prep Type: Total/NA

-	MB	MB							
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
cis-1,2-Dichloroethene	ND		0.20	0.055	ug/L			05/18/21 12:07	1
trans-1,2-Dichloroethene	ND		0.20	0.033	ug/L			05/18/21 12:07	1
Trichloroethene	ND		0.20	0.066	ug/L			05/18/21 12:07	1
Vinyl chloride	ND		0.020	0.013	ug/L			05/18/21 12:07	1

	MB	MB				
Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	101		80 - 120		05/18/21 12:07	1
4-Bromofluorobenzene (Surr)	98		80 - 120		05/18/21 12:07	1
Dibromofluoromethane (Surr)	104		80 - 120		05/18/21 12:07	1
Toluene-d8 (Surr)	101		80 - 120		05/18/21 12:07	1

#### Lab Sample ID: LCS 580-356791/4 Matrix: Water Analysis Batch: 356791

	Spike	LCS	LCS				%Rec.	
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits	
cis-1,2-Dichloroethene	5.00	5.57		ug/L		111	72 - 130	
trans-1,2-Dichloroethene	5.00	5.65		ug/L		113	63 - 133	
Trichloroethene	5.00	5.04		ug/L		101	72 - 136	
Vinyl chloride	5.00	6.13		ug/L		123	69 - 128	

	LCS	LCS	
Surrogate	%Recovery	Qualifier	Limits
1,2-Dichloroethane-d4 (Surr)	101		80 - 120
4-Bromofluorobenzene (Surr)	101		80 - 120

## Method: 8260D - Volatile Organic Compounds by GC/MS (Continued)

Lab Sample ID: LCS 580- Matrix: Water	-356791/4								Cli	ent S	an	nple ID	Lab Co Prep T	ntrol S vpe: To	ample
Analysis Batch: 356791															
	105	109	s												
Surrogate	%Recoverv	Qua	- alifier	Limits											
Dibromofluoromethane (Surr)	106			80 - 120											
Toluene-d8 (Surr)	101			80 - 120											
Lah Sampla ID: LCSD 59	0 256704/5								Client S		10		Control	Some	
Lab Sample ID: LCSD 56	0-356/91/5								chent 5	amp	ie	ID: Lat		Samp	
Matrix: Water													Prep I	ype: Io	otal/NA
Analysis Balch: 556791				Spike		COD	LCOD						% Baa		חחם
Analyte					R		Qualif	fior	Unit		п	%Rec	/intec.	RPL	Limit
cis-1 2-Dichloroethene				5 00		5 38	Quan				_	108	72 - 130		
trans-1 2-Dichloroethene				5.00		5 4 2			ug/L			108	63 133		, 10 . 17
Trichloroethene				5.00		1 81			ug/L			96	72 136	-	· 1/
Vinyl chloride				5.00		5 73			ug/L			115	60 128		, 14 , 21
Virgi chloride				5.00		5.75			ug/L			115	09-120	'	21
	LCSD	LCS	SD												
Surrogate	%Recovery	Qua	alifier	Limits											
1,2-Dichloroethane-d4 (Surr)	101			80 - 120											
4-Bromofluorobenzene (Surr)	100			80 - 120											
Dibromofluoromethane (Surr)	106			80 - 120											
Toluene-d8 (Surr)	100			80 - 120											
Matrix: Water Analysis Batch: 31709												in our	Prep T	ype: To	otal/NA
	_	MB	MB							_	_			_	
Analyte	Re	sult	Qualifier	, 				Jnit		D	Pr	epared		yzed	Dil Fac
Gasoline		ND			150		70 u	ig/L					05/21/2	1 23:20	1
•		MΒ	MB								_				
Surrogate	%Reco	very	Qualifier		S						PI	repared	Anal	yzed	DIIFac
4-Bromofiuorobenzene (Surr)		102		68.7 <b>-</b> 7	41								05/21/2	1 23:20	1
Lab Sample ID: LCS 590-	31709/1004								Cli	ent S	an	nple ID	: Lab Co	ntrol S	Sample
Matrix: Water													Prep T	ype: To	otal/NA
Analysis Batch: 31709															
-				Spike		LCS	LCS						%Rec.		
Analyte				Added	Re	sult	Qualit	fier	Unit		D	%Rec	Limits		
Gasoline				1000		828			ug/L		_	83	80 - 120		
	1.00	1.00	-												
Surroacto	LUS	LU3	Difior	Limito											
4-Bromofluorobenzene (Surr)	0/ Decevery		1111101	LIIIIIIS											
	%Recovery	Que		68 7 1/1											
Lab Sample ID: 590-1513	% <b>Recovery</b> 102	Qui		68.7 - 141											
Matrix: Water	<u>%Recovery</u> 102 0-1 DU	Que		68.7 - 141								Client	Sample I Prep T	D: MW ype: To	1-0511 (1-0511
Matrix: Water Analysis Batch: 31709	<u>%Recovery</u> 102 0-1 DU	<u>Qu</u>		68.7 - 141							1	Client	Sample I Prep T	D: MW ype: To	'1-0511 btal/NA
Matrix: Water Analysis Batch: 31709	- <u>%Recovery</u> 102 0-1 DU Sample	San	nple	68.7 - 141		DU	DU					Client	Sample I Prep T	D: MW ype: To	1-0511 otal/NA RPD
Matrix: Water Analysis Batch: 31709 Analyte	- <u>%Recovery</u> 102 0-1 DU Sample Result	San Qua	nple alifier	68.7 - 141	Re	DU	DU Qualif	fier	Unit		D	Client	Sample I Prep T	D: MW ype: To RPE	1-0511 Dtal/NA RPD Limit

Job ID: 590-15130-1

Job ID: 590-15130-1

5

7

# Method: NWTPH-Gx - Northwest - Volatile Petroleum Products (GC/MS) (Continued)

Lab Sample ID: 590-15130 Matrix: Water Analysis Batch: 31709	-1 DU										Cli	ient S	ample ID: M Prep Type:	W1-0511 Total/NA
	DU	DU												
Surrogate	%Recovery	Qua	lifier	Limits										
4-Bromofluorobenzene (Surr)	102			68.7 - 141										
Lab Sample ID: MB 590-31	722/1-A									Cli	ient	Samp	ole ID: Meth	od Blank
Matrix: Solid													Prep Type:	Total/NA
Analysis Batch: 31715													Prep Bato	:h: 31722
		MB	MB											
Analyte	Re	sult	Qualifier		RL		MDL	Unit			Prep	ared	Analyzed	Dil Fac
Gasoline		ND			5.0		1.8	mg/Kg	9	05/	24/2	1 17:51	05/24/21 19:4	.3 1
		ΜВ	MB											
Surrogate	%Recov	/ery	Qualifier	Limit	ts					I	Prep	ared	Analyzed	Dil Fac
4-Bromofluorobenzene (Surr)		104		41.5 - 1	162					05/	/24/2	1 17:51	05/24/21 19:4	3 1
Lab Sample ID: LCS 590-3	1722/3-A								Clier	it Sa	amp	le ID:	Lab Contro	l Sample
Matrix: Solid													Prep Type:	Total/NA
Analysis Batch: 31715													Prep Bato	h: 31722
· · · · · · · · · · · · · · · · · · ·				Spike		LCS	LCS	;					%Rec.	
Analyte				Added		Result	Qua	lifier	Unit	D	%	Rec	Limits	
Gasoline				50.0		62.2			mg/Kg			124 7	4.4 - 124	
	LCS	LCS	5											
Surrogate	%Recovery	Qua	lifier	Limits										
4-Bromofluorobenzene (Surr)	103			41.5 - 162										

#### Method: 8270E SIM - Semivolatile Organic Compounds (GC/MS SIM)

#### Lab Sample ID: MB 590-31643/1-A Matrix: Water Analysis Batch: 31630

#### Client Sample ID: Method Blank Prep Type: Total/NA Prep Batch: 31643

	MB	MB							
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1-Methylnaphthalene	ND		0.090	0.023	ug/L		05/17/21 12:25	05/17/21 13:19	1
2-Methylnaphthalene	ND		0.090	0.044	ug/L		05/17/21 12:25	05/17/21 13:19	1
Acenaphthene	ND		0.090	0.022	ug/L		05/17/21 12:25	05/17/21 13:19	1
Acenaphthylene	ND		0.090	0.016	ug/L		05/17/21 12:25	05/17/21 13:19	1
Anthracene	ND		0.090	0.025	ug/L		05/17/21 12:25	05/17/21 13:19	1
Benzo[a]anthracene	ND		0.090	0.012	ug/L		05/17/21 12:25	05/17/21 13:19	1
Benzo[a]pyrene	0.0195	J	0.090	0.012	ug/L		05/17/21 12:25	05/17/21 13:19	1
Benzo[b]fluoranthene	ND		0.090	0.025	ug/L		05/17/21 12:25	05/17/21 13:19	1
Benzo[g,h,i]perylene	ND		0.090	0.021	ug/L		05/17/21 12:25	05/17/21 13:19	1
Benzo[k]fluoranthene	ND		0.090	0.015	ug/L		05/17/21 12:25	05/17/21 13:19	1
Chrysene	ND		0.090	0.010	ug/L		05/17/21 12:25	05/17/21 13:19	1
Dibenz(a,h)anthracene	ND		0.090	0.013	ug/L		05/17/21 12:25	05/17/21 13:19	1
Fluoranthene	0.0187	J	0.090	0.017	ug/L		05/17/21 12:25	05/17/21 13:19	1
Fluorene	0.0169	J	0.090	0.016	ug/L		05/17/21 12:25	05/17/21 13:19	1
Indeno[1,2,3-cd]pyrene	0.0254	J	0.090	0.022	ug/L		05/17/21 12:25	05/17/21 13:19	1
Naphthalene	ND		0.090	0.053	ug/L		05/17/21 12:25	05/17/21 13:19	1
Phenanthrene	ND		0.090	0.056	ug/L		05/17/21 12:25	05/17/21 13:19	1
Pyrene	ND		0.090	0.026	ug/L		05/17/21 12:25	05/17/21 13:19	1

Job ID: 590-15130-1

Prep Batch: 31643

Prep Type: Total/NA

Analyzed

05/17/21 12:25 05/17/21 13:19

05/17/21 12:25 05/17/21 13:19

05/17/21 12:25 05/17/21 13:19

**Client Sample ID: Lab Control Sample** 

Prepared

## Method: 8270E SIM - Semivolatile Organic Compounds (GC/MS SIM) (Continued)

#### Lab Sample ID: MB 590-31643/1-A **Matrix: Water**

#### Analysis Batch: 31630

	MB	МВ	
Surrogate	%Recovery	Qualifier	Limits
2-Fluorobiphenyl (Surr)	83		36 - 120
Nitrobenzene-d5	66		29 - 121
p-Terphenyl-d14	107		51 - 121

#### Lab Sample ID: LCS 590-31643/2-A **Matrix: Water**

#### Analysis Batch: 31630 Prep Batch: 31643 Spike LCS LCS %Rec. Analyte Added Result Qualifier Unit D %Rec Limits 1-Methylnaphthalene 1.60 1.19 ug/L 75 49 - 120 1.60 2-Methylnaphthalene 1.20 ug/L 75 44 - 120 Acenaphthene 1.60 1.14 ug/L 71 54 - 120 Acenaphthylene 1.60 1.18 ug/L 74 50 - 120 1.60 78 Anthracene 1.25 ug/L 59 - 120 1.60 68 Benzo[a]anthracene 1.09 ug/L 51 - 128 54 - 120 Benzo[a]pyrene 1.60 1.10 ug/L 69 Benzo[b]fluoranthene 79 1.60 1.26 ug/L 51 - 137 Benzo[g,h,i]perylene 1.60 ug/L 69 55 - 120 1.10 Benzo[k]fluoranthene 1.60 1.38 ug/L 86 58 - 120 Chrysene 1.60 ug/L 74 58 - 126 1.18 Dibenz(a,h)anthracene 1.60 1.28 ug/L 80 51 - 120 Fluoranthene 1.60 82 53 - 120 1.31 ug/L Fluorene 1.60 1.29 ug/L 81 53 - 120 1.60 ug/L 72 46 - 120 Indeno[1,2,3-cd]pyrene 1.16 1.60 82 Naphthalene 1.31 ug/L 52 - 120 Phenanthrene 1.60 79 1.26 ug/L 55 - 120 Pyrene 1.60 81 1.29 ug/L 61 - 126

	LCS	LCS	
Surrogate	%Recovery	Qualifier	Limits
2-Fluorobiphenyl (Surr)	68		36 - 120
Nitrobenzene-d5	66		29 - 121
p-Terphenyl-d14	95		51 - 121

#### Lab Sample ID: LCSD 590-31643/3-A Matrix: Water Analysis Batch: 31630

#### **Client Sample ID: Lab Control Sample Dup** Prep Type: Total/NA Prep Batch: 31643

	Spike	LCSD	LCSD				%Rec.		RPD
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits	RPD	Limit
1-Methylnaphthalene	1.60	1.15		ug/L		72	49 - 120	4	15
2-Methylnaphthalene	1.60	1.17		ug/L		73	44 - 120	3	16
Acenaphthene	1.60	1.15		ug/L		72	54 - 120	1	15
Acenaphthylene	1.60	1.19		ug/L		75	50 - 120	1	15
Anthracene	1.60	1.24		ug/L		78	59 - 120	0	15
Benzo[a]anthracene	1.60	1.12		ug/L		70	51 - 128	2	15
Benzo[a]pyrene	1.60	1.14		ug/L		71	54 - 120	3	15
Benzo[b]fluoranthene	1.60	1.34		ug/L		83	51 - 137	6	15
Benzo[g,h,i]perylene	1.60	1.28		ug/L		80	55 - 120	15	17
Benzo[k]fluoranthene	1.60	1.47		ug/L		92	58 - 120	6	15

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Job ID: 590-15130-1

Prep Type: Total/NA

Client Sample ID: Lab Control Sample Dup

## Method: 8270E SIM - Semivolatile Organic Compounds (GC/MS SIM) (Continued)

#### Lab Sample ID: LCSD 590-31643/3-A Matrix: Water

Analysis Batch: 31630							Prep E	atch:	31643
	Spike	LCSD	LCSD				%Rec.		RPD
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits	RPD	Limit
Chrysene	1.60	1.19		ug/L		74	58 - 126	1	15
Dibenz(a,h)anthracene	1.60	1.39		ug/L		87	51 - 120	8	18
Fluoranthene	1.60	1.29		ug/L		81	53 - 120	1	15
Fluorene	1.60	1.24		ug/L		78	53 - 120	4	15
Indeno[1,2,3-cd]pyrene	1.60	1.28		ug/L		80	46 - 120	10	18
Naphthalene	1.60	1.30		ug/L		81	52 - 120	1	21
Phenanthrene	1.60	1.26		ug/L		79	55 - 120	0	16
Pyrene	1.60	1.04	*1	ug/L		65	61 - 126	21	15

	LCSD	LCSD	
Surrogate	%Recovery	Qualifier	Limits
2-Fluorobiphenyl (Surr)	67		36 - 120
Nitrobenzene-d5	58		29 - 121
p-Terphenyl-d14	89		51 - 121

#### Lab Sample ID: MB 590-31718/1-A Matrix: Solid **Analysis Batch: 31723**

-	MB	МВ						-	
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1-Methylnaphthalene	ND		10	2.2	ug/Kg		05/24/21 11:33	05/24/21 19:41	1
2-Methylnaphthalene	ND		10	3.1	ug/Kg		05/24/21 11:33	05/24/21 19:41	1
Acenaphthene	ND		10	2.5	ug/Kg		05/24/21 11:33	05/24/21 19:41	1
Acenaphthylene	ND		10	3.3	ug/Kg		05/24/21 11:33	05/24/21 19:41	1
Anthracene	ND		10	2.0	ug/Kg		05/24/21 11:33	05/24/21 19:41	1
Benzo[a]anthracene	ND		10	2.1	ug/Kg		05/24/21 11:33	05/24/21 19:41	1
Benzo[a]pyrene	ND		10	4.2	ug/Kg		05/24/21 11:33	05/24/21 19:41	1
Benzo[b]fluoranthene	ND		10	3.5	ug/Kg		05/24/21 11:33	05/24/21 19:41	1
Benzo[g,h,i]perylene	ND		10	2.4	ug/Kg		05/24/21 11:33	05/24/21 19:41	1
Benzo[k]fluoranthene	ND		10	2.5	ug/Kg		05/24/21 11:33	05/24/21 19:41	1
Chrysene	ND		10	1.5	ug/Kg		05/24/21 11:33	05/24/21 19:41	1
Dibenz(a,h)anthracene	ND		10	2.8	ug/Kg		05/24/21 11:33	05/24/21 19:41	1
Fluoranthene	ND		10	2.5	ug/Kg		05/24/21 11:33	05/24/21 19:41	1
Fluorene	ND		10	2.2	ug/Kg		05/24/21 11:33	05/24/21 19:41	1
Indeno[1,2,3-cd]pyrene	ND		10	3.0	ug/Kg		05/24/21 11:33	05/24/21 19:41	1
Naphthalene	ND		10	2.2	ug/Kg		05/24/21 11:33	05/24/21 19:41	1
Phenanthrene	ND		10	3.6	ug/Kg		05/24/21 11:33	05/24/21 19:41	1
Pyrene	ND		10	3.8	ug/Kg		05/24/21 11:33	05/24/21 19:41	1
	МВ	МВ							
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
2-Fluorobiphenyl (Surr)	83		47 - 120	05/24/21 11:33	05/24/21 19:41	1
Nitrobenzene-d5	74		33 - 120	05/24/21 11:33	05/24/21 19:41	1
p-Terphenyl-d14	102		74 - 120	05/24/21 11:33	05/24/21 19:41	1

#### **Client Sample ID: Method Blank** Prep Type: Total/NA Prep Batch: 31718

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Job ID: 590-15130-1

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## Method: 8270E SIM - Semivolatile Organic Compounds (GC/MS SIM) (Continued)

#### Lab Sample ID: LCS 590-31718/2-A Matrix: Solid

Matrix: Solid							Prep Type: Total/NA
Analysis Batch: 31723							Prep Batch: 31718
	Spike	LCS	LCS				%Rec.
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits
1-Methylnaphthalene	267	225		ug/Kg		85	44 - 120
2-Methylnaphthalene	267	223		ug/Kg		84	48 - 120
Acenaphthene	267	219		ug/Kg		82	53 - 120
Acenaphthylene	267	214		ug/Kg		80	52 - 120
Anthracene	267	219		ug/Kg		82	60 - 120
Benzo[a]anthracene	267	243		ug/Kg		91	61 - 131
Benzo[a]pyrene	267	222		ug/Kg		83	60 - 126
Benzo[b]fluoranthene	267	235		ug/Kg		88	61 - 127
Benzo[g,h,i]perylene	267	240		ug/Kg		90	58 - 129
Benzo[k]fluoranthene	267	240		ug/Kg		90	63 - 127
Chrysene	267	248		ug/Kg		93	67 - 127
Dibenz(a,h)anthracene	267	246		ug/Kg		92	60 - 121
Fluoranthene	267	245		ug/Kg		92	63 - 127
Fluorene	267	230		ug/Kg		86	55 - 120
Indeno[1,2,3-cd]pyrene	267	239		ug/Kg		90	63 - 128
Naphthalene	267	204		ug/Kg		76	45 - 120
Phenanthrene	267	230		ug/Kg		86	57 _ 121
Pyrene	267	235		ug/Kg		88	61 - 125

	LCS	LCS	
Surrogate	%Recovery	Qualifier	Limits
2-Fluorobiphenyl (Surr)	101		47 - 120
Nitrobenzene-d5	93		33 - 120
p-Terphenyl-d14	117		74 - 120

## Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC)

Lab Sample ID: MB 590-31728/3-A Matrix: Solid Analysis Batch: 31734	4								Cli	ent Samı	ole ID: Metho Prep Type: T Prep Batch	d Blank otal/NA : 31728
	N	IB MB										
Analyte	Resu	ult Qualifie	er	RL		MDL	Unit	1	D F	Prepared	Analyzed	Dil Fac
1,2-Dibromoethane (EDB)	Ν	ND		0.080	C	.035	ug/Kg		05/2	25/21 11:10	05/25/21 21:28	1
- Lab Sample ID: LCS 590-31728/4-	-A							Clie	nt Sa	mple ID:	Lab Control	Sample
Matrix: Solid											Prep Type: T	otal/NA
Analysis Batch: 31734											Prep Batch	: 31728
· · ·			Spike		LCS	LCS	5				%Rec.	
Analyte			Added		Result	Qua	lifier	Unit	D	%Rec	Limits	
1,2-Dibromoethane (EDB)			1.00		0.985			ug/Kg		99	60 - 140	
_ Lab Sample ID: 590-15130-15 MS									С	lient San	nple ID: SB18	-1-0511
Matrix: Solid											· Prep Type: T	otal/NA
Analysis Batch: 31734											Prep Batch	: 31728
Sa	mple S	Sample	Spike		MS	MS					%Rec.	
Analyte Ro	esult C	Qualifier	Added		Result	Qua	lifier	Unit	D	%Rec	Limits	
1,2-Dibromoethane (EDB)	ND F	-1	1.00		0.582	F1		ug/Kg	— _	58	60 - 140	

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**Client Sample ID: Lab Control Sample** 

Job ID: 590-15130-1

## Method: 8011 - EDB, DBCP, and 1,2,3-TCP (GC) (Continued)

Lab Sample ID: 590-15130-1	5 MSD						Clien	t San	ple ID: S	B18-′	1-0511
Matrix: Solid									Prep Typ	e: To	tal/NA
Analysis Batch: 31734									Prep Ba	atch:	31728
-	Sample S	Sample	Spike	MSD M	SD				%Rec.		RPD
Analyte	Result C	Qualifier	Added	Result Q	ualifier	Unit	D %F	Rec	Limits	RPD	Limit
1,2-Dibromoethane (EDB)	ND F		0.992	0.592		ug/Kg	¢	60	60 - 140	2	20
Lab Sample ID: MB 590-3173	31/1-A						Client	Sam	ole ID: Me	thod	Blank
Matrix: Water									Prep Typ	e: To	tal/NA
Analysis Batch: 31734									Prep Ba	atch:	31731
· ···· <b>,</b> ··· · · · · · · · · ·	Ν	ИВ МВ									
Analyte	Res	ult Qualifier	R	L MD	L Unit	D	Prepa	ared	Analyze	əd	Dil Fac
1,2-Dibromoethane (EDB)		ND	0.01	0 0.002	25 ug/L		05/25/21	13:24	05/26/21 0	2:40	1
- Lab Sample ID: LCS 500 247	24/2 A					Clien	t Compl		Lob Cont		omolo
Lab Sample ID: LCS 590-317	31/2-A					Clien	it Sampi	le ID:			
Watrix: Water									Prep Typ	e: 10	
Analysis Batch: 31734			0		~~				Ргер Ва	atcn:	31731
			Spike		CS			_	%Rec.		
Analyte			Added	Result Q	ualifier	Unit	<u>D%</u> F	Rec _	Limits		
1,2-Dibromoethane (EDB)			0.125	0.120		ug/L		96	60 - 140		
Lab Sample ID: LCSD 590-37 Matrix: Water	1731/3-A				C	Client Sai	mple ID:	Lab	Control S Prep Typ	ampl e: To	e Dup tal/NA
Analysis Batch: 31734									Prep Ba	atch:	31731
			Spike	LCSD L	CSD				%Rec.		RPD
			Addod	Result Q	ualifier	Unit	D %F	Rec	Limits	RPD	Limit
Analyte			Auueu								
Analyte 1,2-Dibromoethane (EDB)			0.125	0.113		ug/L		90	60 - 140	6	20
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychle	orinated	Bipheny	0.125	0.113	Chro	ug/L matogra	aphy	90	60 - 140	6	20
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychle Lab Sample ID: MB 590-3162 Metrix: Woter	orinated 29/1-A	Bipheny	0.125	0.113 by Gas	Chro	ug/L matogra	aphy Client	90 Samp	60 - 140	6 thod	20 Blank
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychle Lab Sample ID: MB 590-3162 Matrix: Water	orinated 29/1-A	Bipheny	0.125	0.113	Chro	ug/L matogra	aphy Client	90 Samp	60 - 140	6 thod e: To	Blank tal/NA
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychle Lab Sample ID: MB 590-3162 Matrix: Water Analysis Batch: 31631	orinated 29/1-A	Bipheny	0.125	0.113	Chro	ug/L matogra	aphy Client	90 Samp	60 - 140 Die ID: Me Prep Typ Prep Ba	6 thod e: To atch:	Blank tal/NA 31629
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychle Lab Sample ID: MB 590-3162 Matrix: Water Analysis Batch: 31631	orinated 29/1-A	Bipheny <sup>/B MB</sup>	0.125	0.113	Chro	ug/L matogra	aphy Client	90 Samp	60 - 140 Die ID: Me Prep Typ Prep Ba	6 thod pe: To atch:	Blank tal/NA 31629
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychle Lab Sample ID: MB 590-3162 Matrix: Water Analysis Batch: 31631 Analyte	orinated 29/1-A Res	Bipheny AB MB ult Qualifier		0.113		ug/L matogra	aphy Client	90 Samp	60 - 140 ble ID: Me Prep Typ Prep Ba Analyze	6 ethod be: To atch:	Blank tal/NA 31629 Dil Fac
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychle Lab Sample ID: MB 590-3162 Matrix: Water Analysis Batch: 31631 Analyte PCB-1016 POD 1001	orinated 29/1-A Res	Bipheny MB MB ult Qualifier	<u>.125</u> (s (PCBs) <u>- R</u> 0.1	0.113 by Gas	Chro L Unit	ug/L matogra	aphy Client Prepa 05/16/21	90 Samp ared   16:29	60 - 140 <b>Die ID: Me</b> <b>Prep Typ</b> <b>Prep Ba</b> 05/17/21 1	6 ethod e: To atch: ad 4:02	Blank tal/NA 31629 Dil Fac
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychlo Lab Sample ID: MB 590-3162 Matrix: Water Analysis Batch: 31631 Analyte PCB-1016 PCB-1221	orinated 29/1-A Ress	Bipheny IB MB ult Qualifier	<u>.125</u> ( <b>PCBS</b> ) ( <b>R</b> (0.1 0.1	0.113 by Gas	Chro DL Unit 32 ug/L 32 ug/L	ug/L matogra	aphy Client Prepa 05/16/21 05/16/21	90 Samp ared   16:29   16:29	60 - 140 <b>Die ID: Me</b> <b>Prep Typ</b> <b>Prep Ba</b> <b>Analyze</b> 05/17/21 1 05/17/21 1	6 thod pe: To atch: ad 4:02 4:02	Blank tal/NA 31629 Dil Fac
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychlo Lab Sample ID: MB 590-3162 Matrix: Water Analysis Batch: 31631 Analyte PCB-1016 PCB-1221 PCB-1232	orinated 29/1-A M Resi	Bipheny MB MB ult Qualifier ND ND	0.125	0.113 by Gas by Gas	Chro L Unit 2 ug/L 2 ug/L 2 ug/L	ug/L matogra	<b>Client</b> Client 05/16/21 05/16/21 05/16/21	90 Samp 16:29 16:29 16:29	60 - 140 <b>Die ID: Me</b> <b>Prep Typ</b> <b>Prep Ba</b> 05/17/21 1 05/17/21 1	6 ethod e: To atch: ed 4:02 4:02 4:02	<b>Blank</b> tal/NA 31629 Dil Fac 1 1 1
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychlo Lab Sample ID: MB 590-3162 Matrix: Water Analysis Batch: 31631 Analyte PCB-1016 PCB-1221 PCB-1232 PCB-1242	orinated 29/1-A Resi	Bipheny MB MB ult Qualifier ND ND ND	0.125 (PCBs) (0.1 0.1 0.1 0.1 0.1 0.1 0.1	0.113 by Gas by Gas	Chro L Unit 2 ug/L 2 ug/L 2 ug/L 2 ug/L	ug/L matogra	<b>Client</b> Client 05/16/21 05/16/21 05/16/21 05/16/21	90 Samp 16:29 16:29 16:29 16:29	60 - 140 <b>Die ID: Me</b> <b>Prep Typ</b> <b>Prep Ba</b> 05/17/21 1 05/17/21 1 05/17/21 1	6 thod e: To atch: ed 4:02 4:02 4:02 4:02	<b>Blank</b> tal/NA 31629 Dil Fac 1 1 1 1
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychlo Lab Sample ID: MB 590-3162 Matrix: Water Analysis Batch: 31631 Analyte PCB-1016 PCB-1221 PCB-1242 PCB-1248	orinated 29/1-A Resi	Bipheny MB MB ult Qualifier ND ND ND ND	.125 (PCBs) 	0.113 by Gas by Gas by Cos 0 0.06 0 0.06 0 0.06 0 0.06	Chro           0L         Unit           32         ug/L	ug/L matogra	<b>Client</b> <b>Client</b> 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21	90 Samp 16:29 16:29 16:29 16:29 16:29	60 - 140 <b>Die ID: Me</b> <b>Prep Typ</b> <b>Prep Ba</b> 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1	6 thod be: To atch: 4:02 4:02 4:02 4:02 4:02	Blank           tal/NA           31629           Dil Fac           1           1           1           1           1           1           1
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychlo Lab Sample ID: MB 590-3162 Matrix: Water Analysis Batch: 31631 Analyte PCB-1016 PCB-1221 PCB-1232 PCB-1242 PCB-1248 PCB-1254	orinated 29/1-A Resi	Bipheny MB MB ult Qualifier ND ND ND ND ND ND	(PCBs)	0.113 by Gas by Gas by Cos 0 0.06 0 0.06 0 0.06 0 0.06 0 0.06 0 0.06	Chro L Unit 2 ug/L 2 ug/L 2 ug/L 2 ug/L 2 ug/L 2 ug/L 2 ug/L	ug/L matogra	<b>Client</b> <b>Client</b> 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21	90 Samp 16:29 16:29 16:29 16:29 16:29 16:29	60 - 140 <b>Die ID: Me</b> <b>Prep Typ</b> <b>Prep Ba</b> 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1	6 thod te: To atch: ad 4:02 4:02 4:02 4:02 4:02 4:02 4:02	<b>Blank</b> tal/NA 31629 Dil Fac 1 1 1 1 1 1 1
Analyte           1,2-Dibromoethane (EDB)           Method:         8082A - Polychle           Lab Sample ID:         MB 590-3162           Matrix:         Water           Analysis Batch:         31631           Analyte         PCB-1016           PCB-1221         PCB-1232           PCB-1242         PCB-1244           PCB-1254         PCB-1254           PCB-1260         PCB-1260	orinated 29/1-A Res	Bipheny Bipheny MB MB Ult Qualifier ND	R           0.125           Is (PCBs)           0.1	0.113 by Gas MD 0 0.06 0 0	Chro           0L         Unit           52         ug/L           52         ug/L           52         ug/L           52         ug/L           52         ug/L           52         ug/L           53         ug/L           54         ug/L           55         ug/L           56         ug/L	ug/L matogra	aphy Client Definition Official Official Official Official Official Official Official Official Official Official	90 Samp 16:29 16:29 16:29 16:29 16:29 16:29 16:29	60 - 140 <b>Die ID: Me</b> <b>Prep Typ</b> <b>Prep Ba</b> 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1	6 thod e: To atch: ed 4:02 4:02 4:02 4:02 4:02 4:02 4:02 4:02 4:02	20 Blank tal/NA 31629 Dil Fac 1 1 1 1 1 1 1 1 1 1 1
Analyte           1,2-Dibromoethane (EDB)           Method:         8082A - Polychle           Lab Sample ID:         MB 590-3162           Matrix:         Water           Analysis Batch:         31631           Analyte         PCB-1016           PCB-1221         PCB-1232           PCB-1242         PCB-1244           PCB-1254         PCB-1254           PCB-1260         PCB-1260	orinated 29/1-A Result N	Bipheny MB MB ult Qualifier ND	R           0.125           Is (PCBs)           0.1	0.113 by Gas by Gas	Chro           0L         Unit           32         ug/L	ug/L matogra	<b>Client</b> <b>Client</b> 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21	90 Samp 16:29 16:29 16:29 16:29 16:29 16:29 16:29	60 - 140 <b>Die ID: Me</b> <b>Prep Typ</b> <b>Prep Ba</b> 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1	6 thod te: To atch: ad 4:02 4:02 4:02 4:02 4:02 4:02 4:02 4:02	Blank tal/NA 31629 Dil Fac 1 1 1 1 1 1 1 1 1 1
Analyte           1,2-Dibromoethane (EDB)           Method:         8082A - Polychle           Lab Sample ID:         MB 590-3162           Matrix:         Water           Analysis Batch:         31631           Analyte         PCB-1016           PCB-1221         PCB-1232           PCB-1242         PCB-1244           PCB-1254         PCB-1260           Surrogate         Surrogate	orinated 29/1-A Result N N N N N N N N N N N N N N N N Recover	Bipheny MB MB ult Qualifier ND	R           0.125           Is (PCBs)           0.125           0.125           Is (PCBs)           0.1	0.113 by Gas by Gas	Chro           32         Unit           32         ug/L           32         ug/L           32         ug/L           32         ug/L           32         ug/L           32         ug/L           33         ug/L	ug/L matogra	Client Client 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21 Prepa	90 Samp 16:29 16:29 16:29 16:29 16:29 16:29 16:29	60 - 140 <b>Die ID: Me</b> <b>Prep Typ</b> <b>Prep Ba</b> 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1	6 athod atch: ad 4:02 4:0	Blank           tal/NA           31629           Dil Fac           1
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychlo Lab Sample ID: MB 590-3162 Matrix: Water Analysis Batch: 31631 Analyte PCB-1016 PCB-1221 PCB-1222 PCB-1242 PCB-1242 PCB-1248 PCB-1254 PCB-1254 PCB-1260 Surrogate Tetrachloro-m-xylene	orinated 29/1-A Res N N N N N N N N N N N N N N N N N N N	Bipheny MB MB ult Qualifier ND ND ND ND ND ND ND ND ND ND ND ND ND	R           0.125           Is (PCBs)           Is (PCBs)           0.1	0.113 by Gas by Gas	Chro L Unit 2 ug/L 2 ug/L 2 ug/L 2 ug/L 2 ug/L 3 ug/L 3 ug/L	ug/L matogra	Client Client 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21 Prepa 05/16/21	90 Samp 16:29 16:29 16:29 16:29 16:29 16:29 16:29	60 - 140 <b>Die ID: Me</b> <b>Prep Typ</b> <b>Prep Ba</b> 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1	6 athod atch: ad 4:02 4:0	20 Blank tal/NA 31629 Dil Fac 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychle Lab Sample ID: MB 590-3162 Matrix: Water Analysis Batch: 31631 Analyte PCB-1016 PCB-1221 PCB-1222 PCB-1242 PCB-1242 PCB-1248 PCB-1254 PCB-1254 PCB-1254 PCB-1260 Surrogate Tetrachloro-m-xylene DCB Decachlorobiphenyl (Surr)	orinated 29/1-A N Res N N N N N N N N N N N N N N N N N N N	Bipheny Bipheny MB MB Ult Qualifier ND	R           0.125           Is (PCBs)           Is (PCBs)           0.1	0.113 by Gas by Gas	Chro L Unit 2 ug/L 2 ug/L 2 ug/L 2 ug/L 2 ug/L 3 ug/L 3 ug/L	ug/L matogra	aphy Client OS/16/21 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21	90 Samp 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29	60 - 140 <b>Die ID: Me</b> <b>Prep Typ</b> <b>Prep Ba</b> 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1	6 thod e: To atch: ed 4:02 4:0	20 Blank tal/NA 31629 Dil Fac 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychlo Lab Sample ID: MB 590-3162 Matrix: Water Analysis Batch: 31631 Analyte PCB-1016 PCB-1221 PCB-1222 PCB-1242 PCB-1242 PCB-1248 PCB-1254 PCB-1254 PCB-1254 PCB-1260 Surrogate Tetrachloro-m-xylene DCB Decachlorobiphenyl (Surr) Lab Sample ID: LCS 590-316 Matrix: Water	orinated 29/1-A N Res N N N N N N N S29/2-A	Bipheny MB MB ult Qualifier ND ND ND ND ND MB MB ery Qualifier 98	R           0.125           Is (PCBs)           0.125           0.125           Is (PCBs)           0.1 <td>0.113 by Gas by Gas</td> <td>Chro L Unit 2 ug/L 2 ug/L 2 ug/L 2 ug/L 3 ug/L 3 ug/L</td> <td>ug/L matogra</td> <td>Client Client 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21</td> <td>90 Samp 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29</td> <td>60 - 140 <b>Die ID: Me</b> <b>Prep Typ</b> <b>Prep Ba</b> 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 <b>Analyze</b> 05/17/21 1 <b>Lab Cont</b> <b>Prep Typ</b></td> <td>6 thod e: To atch: ed 4:02 4:0</td> <td>20 Blank tal/NA 31629 Dil Fac 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</td>	0.113 by Gas by Gas	Chro L Unit 2 ug/L 2 ug/L 2 ug/L 2 ug/L 3 ug/L 3 ug/L	ug/L matogra	Client Client 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21	90 Samp 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29	60 - 140 <b>Die ID: Me</b> <b>Prep Typ</b> <b>Prep Ba</b> 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 <b>Analyze</b> 05/17/21 1 <b>Lab Cont</b> <b>Prep Typ</b>	6 thod e: To atch: ed 4:02 4:0	20 Blank tal/NA 31629 Dil Fac 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychle Lab Sample ID: MB 590-3162 Matrix: Water Analysis Batch: 31631 Analyte PCB-1016 PCB-1221 PCB-1222 PCB-1242 PCB-1242 PCB-1254 PCB-1254 PCB-1254 PCB-1254 PCB-1260 Surrogate Tetrachloro-m-xylene DCB Decachlorobiphenyl (Surr) Lab Sample ID: LCS 590-316 Matrix: Water Analysis Batch: 31631	orinated 29/1-A N Res N N N N N N N S 29/2-A	Bipheny MB MB ult Qualifier ND ND ND ND ND MB MB ery 98	R           0.125           Is (PCBs)           Is (PCBs)           0.125           Is (PCBs)	0.113 by Gas by Gas	Chro L Unit 2 ug/L 2 ug/L 2 ug/L 2 ug/L 2 ug/L 3 ug/L 3 ug/L	ug/L matogra	Prepa           05/16/21	90 Samp 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29	60 - 140 <b>Die ID: Me</b> <b>Prep Typ</b> <b>Prep Ba</b> 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 <b>Analyze</b> 05/17/21 1 <b>Lab Cont</b> <b>Prep Typ</b> <b>Prep Ba</b>	6 thod e: To atch: ed 4:02 4:0	20 Blank tal/NA 31629 Dil Fac 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychle Lab Sample ID: MB 590-3162 Matrix: Water Analysis Batch: 31631 Analyte PCB-1016 PCB-1221 PCB-1222 PCB-1242 PCB-1242 PCB-1248 PCB-1254 PCB-1254 PCB-1260 Surrogate Tetrachloro-m-xylene DCB Decachlorobiphenyl (Surr) Lab Sample ID: LCS 590-316 Matrix: Water Analysis Batch: 31631	orinated 29/1-A N Resi	Bipheny MB MB ult Qualifier ND ND ND ND MB MB ery Qualifier 98	R           0.125           Is (PCBs)           Is (PCBs)           0.1	0.113 by Gas by Gas 0 0.06 0 0.06	Chro L Unit 2 ug/L 2 ug/L 2 ug/L 2 ug/L 2 ug/L 3 ug/L 3 ug/L	ug/L matogra	aphy Client Client 05/16/21 05/16/21 05/16/21 05/16/21 05/16/21 Prepa 05/16/21 05/16/21 105/16/21 05/16/21	90 Samp 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29	60 - 140 <b>Die ID: Me</b> <b>Prep Typ</b> <b>Prep Ba</b> 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 <b>Analyze</b> 05/17/21 1 <b>Lab Cont</b> <b>Prep Typ</b> <b>Prep Ba</b> %Rec.	6 thod e: To atch: ed 4:02 4:0	20 Blank tal/NA 31629 Dil Fac 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychlo Lab Sample ID: MB 590-3162 Matrix: Water Analysis Batch: 31631 Analyte PCB-1016 PCB-1221 PCB-1222 PCB-1242 PCB-1242 PCB-1248 PCB-1254 PCB-1254 PCB-1260 Surrogate Tetrachloro-m-xylene DCB Decachlorobiphenyl (Surr) Lab Sample ID: LCS 590-316 Matrix: Water Analysis Batch: 31631 Analyte	orinated 29/1-A N Resi N N N N %Recove	Bipheny MB MB ult Qualifier ND	Kuded           0.125           Is (PCBs)           Is (PCBs)           0.125           Is (PCBs)           Is (PCBs) </td <td>0.113 by Gas by Gas 0 0.06 0 0</td> <td>Chro L Unit 2 ug/L 2 ug/L 2 ug/L 2 ug/L 2 ug/L 3 ug/L 3 ug/L 3 ug/L</td> <td>ug/L matogra</td> <td>aphy Client Client 05/16/21 05/1</td> <td>90 Samp 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29</td> <td>60 - 140 <b>Die ID: Me</b> <b>Prep Typ</b> <b>Prep Ba</b> 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 <b>Analyze</b> 05/17/21 1 <b>Lab Cont</b> <b>Prep Typ</b> <b>Prep Ba</b> %Rec. Limits</td> <td>6 thod e: To atch: ad 4:02 4:02 4:02 4:02 4:02 4:02 4:02 4:02</td> <td>20 Blank tal/NA 31629 Dil Fac 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</td>	0.113 by Gas by Gas 0 0.06 0 0	Chro L Unit 2 ug/L 2 ug/L 2 ug/L 2 ug/L 2 ug/L 3 ug/L 3 ug/L 3 ug/L	ug/L matogra	aphy Client Client 05/16/21 05/1	90 Samp 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29	60 - 140 <b>Die ID: Me</b> <b>Prep Typ</b> <b>Prep Ba</b> 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 <b>Analyze</b> 05/17/21 1 <b>Lab Cont</b> <b>Prep Typ</b> <b>Prep Ba</b> %Rec. Limits	6 thod e: To atch: ad 4:02 4:02 4:02 4:02 4:02 4:02 4:02 4:02	20 Blank tal/NA 31629 Dil Fac 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Analyte 1,2-Dibromoethane (EDB) Method: 8082A - Polychlo Lab Sample ID: MB 590-3162 Matrix: Water Analysis Batch: 31631 Analyte PCB-1016 PCB-1221 PCB-1232 PCB-1242 PCB-1242 PCB-1254 PCB-1260 Surrogate Tetrachloro-m-xylene DCB Decachlorobiphenyl (Surr) Lab Sample ID: LCS 590-316 Matrix: Water Analysis Batch: 31631 Analyte PCB-1016	orinated 29/1-A N Resi	Bipheny MB MB ult Qualifier ND ND ND ND ND ND ND ND ND MB MB ery Qualifier 98	Kuded           0.125           Is (PCBs)           Is (0.1           0.1	0.113 by Gas by Gas D 0 0.06 0 0.0	Chro L Unit 2 ug/L 2 ug/L 2 ug/L 2 ug/L 2 ug/L 3 ug/L 3 ug/L 3 ug/L	ug/L matogra	Prepa           05/16/21	90 Samp 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29 16:29	60 - 140 <b>Die ID: Me</b> <b>Prep Typ</b> <b>Prep Ba</b> 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 05/17/21 1 <b>Analyze</b> 05/17/21 1 <b>Lab Contt</b> <b>Prep Typ</b> <b>Prep Ba</b> %Rec. Limits 44 - 120	6 athod atch: ad 4:02 4:0	Blank           tal/NA           31629           Dil Fac           1

Limits

20 - 120

39 - 120

Spike

Added

Limits

20 - 120

39 - 120

1.60

1.60

Analysis Batch: 31631

DCB Decachlorobiphenyl (Surr)

Analysis Batch: 31631

**Matrix: Water** 

Tetrachloro-m-xylene

**Matrix: Water** 

Surrogate

Analyte

PCB-1016

PCB-1260

Surrogate

Tetrachloro-m-xylene

Lab Sample ID: LCS 590-31629/2-A

Lab Sample ID: LCSD 590-31629/3-A

LCS LCS %Recovery Qualifier

LCSD LCSD

....

...

%Recovery Qualifier

54

103

57

101

#### Job ID: 590-15130-1 Method: 8082A - Polychlorinated Biphenyls (PCBs) by Gas Chromatography (Continued) **Client Sample ID: Lab Control Sample** Prep Type: Total/NA Prep Batch: 31629 7 **Client Sample ID: Lab Control Sample Dup** Prep Type: Total/NA Prep Batch: 31629 LCSD LCSD RPD %Rec. Result Qualifier Unit D %Rec Limits RPD Limit 1.18 ug/L 74 44 - 120 4 17 48 - 120 21 1.30 ug/L 81 1 **Client Sample ID: Method Blank** Prep Type: Total/NA

#### **Matrix: Solid** Analysis Batch: 31726

Lab Sample ID: MB 590-31727/1-A

DCB Decachlorobiphenyl (Surr)

	IVIB	MB							
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
PCB-1016	ND		10	2.2	ug/Kg		05/25/21 10:45	05/25/21 12:22	1
PCB-1221	ND		10	2.2	ug/Kg		05/25/21 10:45	05/25/21 12:22	1
PCB-1232	ND		10	2.2	ug/Kg		05/25/21 10:45	05/25/21 12:22	1
PCB-1242	ND		10	2.2	ug/Kg		05/25/21 10:45	05/25/21 12:22	1
PCB-1248	ND		10	2.2	ug/Kg		05/25/21 10:45	05/25/21 12:22	1
PCB-1254	ND		10	2.2	ug/Kg		05/25/21 10:45	05/25/21 12:22	1
PCB-1260	ND		10	2.2	ug/Kg		05/25/21 10:45	05/25/21 12:22	1

	IVI B	MB	
Surrogate	%Recovery	Qualifier	Limits
Tetrachloro-m-xylene	85		22 - 131
DCB Decachlorobiphenyl (Surr)	95		32 - 150

#### Lab Sample ID: LCS 590-31727/2-A Matrix: Solid Analysis Batch: 31726

· ·····, · ··· · · · · · · · · · · · ·		Spike	LCS	LCS				%Rec.	
Analyte		Added	Result	Qualifier	Unit	D	%Rec	Limits	
PCB-1016		66.7	60.2		ug/Kg		90	55 - 136	
PCB-1260		66.7	71.2		ug/Kg		107	63 - 143	
	LCS LCS								

	200	200	
Surrogate	%Recovery	Qualifier	Limits
Tetrachloro-m-xylene	91		22 - 131
DCB Decachlorobiphenyl (Surr)	108		32 - 150

#### Prepared Analyzed Dil Fac 05/25/21 10:45 05/25/21 12:22 1

#### 05/25/21 10:45 05/25/21 12:22 1 **Client Sample ID: Lab Control Sample**

Prep Type: Total/NA

Ρ	re	р	В	at	ch	1:	31	7	2	7

## Method: NWTPH-Dx - Northwest - Semi-Volatile Petroleum Products (GC)

Analysis Batch: 31736MBMBAnalysis Batch: 31736Result QualifierRLMDLUnitDPreparedAnalyzDiesel Range Organics (DRO)ND0.240.11mg/LD05/25/21Analyz(C10-C25)Residual Range Organics (RRO)ND0.400.12mg/L05/25/2105/25/2105/25/21(C25-C36)MBMBSurrogate%RecoveryQualifierLimitsDPreparedAnalyzo-Terphenyl8850-15005/25/2105/25/2114:4605/25/21Lab Sample ID: LCS 590-31735/2-AClient Sample ID: Lab Con Matrix: WaterPrep B%RecPrep Ty Analysis Batch: 31736Prep BAnalyteAddedResultQualifierUnit 1.60D%RecWRecDiesel Range Organics (DRO) (C10-C25)1.601.65mg/LD%RecLimitsDiesel Range Organics (DRO) (C10-C25)1.601.65mg/L10350-150Cibesel Range Organics (RRO) (C25-C36)1.601.65mg/L10350-150Surrogate o-Terphenyl n-Triacontane-d62%Recovery 85Qualifier 50-150Limits 50-150Los Los DostLimits Residual Range Organics (RRO) RCO1.601.65mg/L10350-150Lab Sample ID: LCSD 590-31735/3-A Matrix: Water Analysis Batch: 31736Limits 50-150Client Sample ID: Lab Control S Prep Ty Analysis Batch: 31736Prep Ty Prep Ty	atch: 31735         ed       Dil Fac         17:20       1         17:20       1         ed       Dil Fac         17:20       1         trol Sample       1         be: Total/NA       31735
MB         MB         MB         MB         MB         ML         Unit         D         Prepared         Analyz           Diesel Range Organics (DRO)         ND         0.24         0.11         mg/L         05/25/21         4.46         05/25/21           (C10-C25)         Residual Range Organics (RRO)         ND         0.40         0.12         mg/L         05/25/21         4.46         05/25/21           (C25-C36)         MB         MB         MB         05/25/21         4.46         05/25/21           Surrogate         %Recovery         Qualifier         Limits         0.12         mg/L         05/25/21         4.46         05/25/21           o-Terphenyl         88         50 - 150         05/25/21         14.46         05/25/21           Lab Sample ID: LCS 590-31735/2-A         Keevery         Qualifier         Limits         05/25/21         14.46         05/25/21           Lab Sample ID: LCS 590-31735/2-A         Client Sample ID: Lab Con         Prepared         Analyz         Prep B           Matrix: Water         Analyz         Added         Result         Qualifier         Unit         D         %Rec         Units         50 - 150           Surrogate         KRecovery         Quali	ed       Dil Fac         17:20       1         17:20       1         ed       Dil Fac         17:20       1         17:20       1         trol Sample       De: Total/NA         atch: 31735
AnalyteResultQualifierRLMDLUnitDPreparedAnalyzDiesel Range Organics (DRO)ND0.240.11mg/L05/25/2105/25/2105/25/21(C10-C25)Residual Range Organics (RRO)ND0.400.12mg/L05/25/2114:4605/25/21(C25-C36)MBMBSurrogate%RecoveryQualifierLimits05/25/2105/25/2114:4605/25/21o-Terphenyl8850 - 15005/25/2114:4605/25/2105/25/21n-Triacontane-d627650 - 15005/25/2114:4605/25/21Lab Sample ID: LCS 590-31735/2-ASpikeLCSLCSLCSLSVRec.Analyte4ddedResultQualifierUnitD%Rec.WRec.Diesel Range Organics (DRO)1.601.35mg/L0350 - 15050 - 150(C10-C25)KeecoveryQualifier1.601.35mg/L10350 - 150(C25-C36)LCSLCSLCSSo - 15010350 - 15050 - 150Surrogate%RecoveryQualifierLimits50 - 15010350 - 150o-Terphenyl8550 - 15050 - 15010350 - 15010350 - 150Lab Sample ID: LCSD 590-31735/3-AKecoveryQualifierLimits50 - 1507676n-Triacontane-d628150 - 15050 - 1507676767676 <tr< td=""><td>ed         Dil Fac           17:20         1           17:20         1           ed         Dil Fac           17:20         1           17:20         1           trol Sample         1           be: Total/NA         31735</td></tr<>	ed         Dil Fac           17:20         1           17:20         1           ed         Dil Fac           17:20         1           17:20         1           trol Sample         1           be: Total/NA         31735
Diesel Range Organics (DRO) (C10-C25) Residual Range Organics (RRO)         ND         0.24         0.11         mg/L         05/25/21         05/25/21         05/25/21         04/26         05/25/21         05/25/21         04/26         05/25/21         04/26         05/25/21         05/25/21         04/26         05/25/21         04/26         05/25/21         04/26         05/25/21         04/26         05/25/21         04/26         05/25/21         04/26         05/25/21         05/25/21         04/26         05/25/21         05/25/21         04/26         05/25/21         05/25/21         04/26         05/25/21         05/25/21         04/26         05/25/21         04/26         05/25/21         05/25/21         04/26         05/25/21         05/25/21         04/26         05/25/21         05/25/21         04/26         05/25/21         04/26         05/25/21         05/25/21         04/26         05/25/21         04/26         05/25/21         04/26         05/25/21         05/25/21         04/26         05/25/21         04/26         05/25/21         04/26         05/25/21         04/26         05/25/21         05/25/21         04/26         05/25/21         04/26         05/25/21         05/25/21         05/25/21         04/26         05/25/21         05/25/21         05/25/21 <td>17:20       1         17:20       1         17:20       1         17:20       1         17:20       1         trol Sample       1         be: Total/NA       1735        </td>	17:20       1         17:20       1         17:20       1         17:20       1         17:20       1         trol Sample       1         be: Total/NA       1735
MB         MB         MB           Surrogate         %Recovery         Qualifier         Limits         05/25/21         14:46         05/25/21           o-Terphenyl         88         50.150         05/25/21         14:46         05/25/21           Lab Sample ID: LCS 590-31735/2-A         76         50.150         05/25/21         14:46         05/25/21           Lab Sample ID: LCS 590-31735/2-A         Client Sample ID: Lab Con         Prep Tyr           Analyte         76         50.150         05/25/21         14:46         05/25/21           Lab Sample ID: LCS 590-31735/2-A         Client Sample ID: Lab Con         Prep Tyr           Analyte         Analyte         ND         1.60         1.35         mg/L         0         %Rec.         Limits           Diesel Range Organics (DRO)         1.60         1.65         mg/L         103         50.150           (C10-C25)         Residual Range Organics (RRO)         1.60         1.65         mg/L         103         50.150           (C25-C36)         LCS         LCS         50.150         103         50.150           Surrogate         %Recovery         Qualifier         Limits         50.150           o-Terphenyl         85         <	ed       Dil Fac         17:20       1         17:20       1         trol Sample       De: Total/NA         atch:       31735
MB       MB       MB         Surrogate       %Recovery       Qualifier       Limits       05/25/21       Analyz         o-Terphenyl       88       50-150       05/25/21       14:46       05/25/21         n-Triacontane-d62       76       50-150       05/25/21       14:46       05/25/21         Lab Sample ID: LCS 590-31735/2-A       Client Sample ID: Lab Con       Prep Ty         Matrix: Water       Analyz       Prep Ty       Prep Ty         Analyte       Added       Result       Qualifier       Unit       D       %Rec.         Diesel Range Organics (DRO)       1.60       1.35       mg/L       103       50-150         (C10-C25)       Residual Range Organics (RRO)       1.60       1.65       mg/L       103       50-150         (C25-C36)       LCS       LCS       Solutifier       Limits       50-150       50-150         Surrogate       %Recovery       Qualifier       Limits       50-150       50-150       50-150         Lab Sample ID: LCSD 590-31735/3-A       Kecovery       Qualifier       Limits       50-150       Prep Ty         -Triacontane-d62       81       50-150       50-150       50-150       50-150       Client Sample ID:	ed <u>Dil Fac</u> 17:20 1 trol Sample pe: Total/NA atch: 31735
MBMBSurrogate o-Terphenyl%Recovery 88Qualifier 50 - 150Limits 50 - 150Prepared 05/25/21 14:46Analyz 05/25/21 14:46Analyz 05/25/21 14:46I.ab Sample ID: LCS 590-31735/2-A Matrix: Water Analysis Batch: 31736Client Sample ID: Lab Con Prep Tyr Prep B %Rec.Analyte Diesel Range Organics (DRO) (C10-C25)Spike 1.60LCS 1.60LCS 1.65LCS mg/LMRcc. 	ed <u>Dil Fac</u> 17:20 1 trol Sample be: Total/NA atch: 31735
Surrogate o-Terphenyl%Recovery 88Qualifier 50.150Limits 50.150Prepared 05/25/21 14:46Analyz 05/25/21 14:46Analyz 05/25/21 14:46Analyz 05/25/21 14:46Analyz 05/25/21 14:46Analyz 05/25/21 14:46Analyz 05/25/21 14:46Analyz 05/25/21 14:46Analyz 	ed     Dil Fac       17:20     1       17:20     1       trol Sample       be: Total/NA       atch: 31735
o-Terphenyl         88         50.150         05/25/21 14:46         05/25/21           n-Triacontane-d62         76         50.150         05/25/21 14:46         05/25/21           Lab Sample ID: LCS 590-31735/2-A         Client Sample ID: Lab Con         Prep Tyl           Analysis Batch: 31736         Spike         LCS LCS         WRec.           Analyte         Spike         LCS LCS         VRec.           Diesel Range Organics (DRO)         1.60         1.35         mg/L         D         %Rec.           (C10-C25)         Residual Range Organics (RRO)         1.60         1.65         mg/L         103         50-150           (C25-C36)         LCS LCS         Matrix:         Matrix:         Spike         Limits         50-150           Surrogate         %Recovery         Qualifier         Limits         50-150         50-150           n-Triacontane-d62         81         50-150         50-150         50-150         50-150           Lab Sample ID: LCSD 590-31735/3-A         Client Sample ID: Lab Control S         Prep Typ           Matrix: Water         Prep B         Prep Typ           Analysis Batch: 31736         Prep B         Prep Typ	itrol Sample be: Total/NA atch: 31735
In-Inacontane-d62     76     50.150     05/25/21 14:46     05/25/21       Lab Sample ID: LCS 590-31735/2-A Matrix: Water     Client Sample ID: Lab Con Prep Ty, Prep B       Analyte     Spike     LCS LCS     WRec.       Diesel Range Organics (DRO) (C10-C25)     1.60     1.35     mg/L     D     %Rec.       Residual Range Organics (RRO) (C25-C36)     1.60     1.65     mg/L     103     50-150       Surrogate o-Terphenyl     %Recovery 85     Qualifier 50-150     Limits 50-150       Lab Sample ID: LCSD 590-31735/3-A Matrix: Water Analysis Batch: 31736     Client Sample ID: Lab Control S Prep Typ	trol Sample be: Total/NA atch: 31735
Lab Sample ID: LCS 590-31735/2-A Matrix: Water Analysis Batch: 31736Client Sample ID: Lab Con Prep Ty Prep BAnalyte Diesel Range Organics (DRO) (C10-C25) Residual Range Organics (RRO) (C25-C36)Spike AddedLCS Result 1.60LCS 1.35LCS mg/LMatrix Diesel Range Organics (RRO) (C25-C36)LCS LCS LCS LCS 1.60Nitt 1.65D More mg/LD WRec 85Limits 50 - 150Los Surrogate o-Terphenyl n-Triacontane-d62%Recovery 81Qualifier 50 - 150Limits 50 - 150Client Sample ID: Lab Control S Prep Ty Prep Ty 	trol Sample be: Total/NA atch: 31735
Matrix: Water Analysis Batch: 31736Spike AddedLCS LCS LCS AddedLCS Result 	atch: 31735
Analysis Batch: 31736       Prep B         Analyte       Spike       LCS       LCS       VRec.         Diesel Range Organics (DRO)       1.60       1.35       mg/L       D       %Rec.       Limits         O(C10-C25)       Residual Range Organics (RRO)       1.60       1.65       mg/L       103       50 - 150         (C25-C36)       LCS       LCS       LCS       Solution       1.65       mg/L       103       50 - 150         (C25-C36)       LCS       LCS       Solution       1.65       mg/L       103       50 - 150         (C25-C36)       LCS       LCS       Solution       1.65       mg/L       103       50 - 150         (C25-C36)       LCS       LCS       Solution       Solution       1.65       mg/L       103       50 - 150         (C25-C36)       LCS       LCS       Solution       So	atch: 31735
AnalyteSpikeLCSLCSLCSLCSLimitsDiesel Range Organics (DRO) (C10-C25) Residual Range Organics (RRO)1.601.35QualifierUnitD%Rec.Limits0.25-C36)1.601.65mg/L10350-150LCSLCSSurrogate o-Terphenyl n-Triacontane-d62%Recovery 81QualifierLimits 50-150Lab Sample ID: LCSD 590-31735/3-A Matrix: Water Analysis Batch: 31736Client Sample ID: Lab Control S Prep B	ample Dup
AnalyteAddedResultQualifierUnitD%RecLimitsDiesel Range Organics (DRO) (C10-C25) Residual Range Organics (RRO)1.601.35mg/L08550 - 150(C25-C36)LCSLCSLCSSurrogate%RecoveryQualifierLimits0-Terphenyl8550 - 15050 - 150n-Triacontane-d628150 - 150Lab Sample ID: LCSD 590-31735/3-A Matrix: Water Analysis Batch: 31736Client Sample ID: Lab Control S Prep B	ample Dup
Linity I         Initial         Initia <thinitial< th=""> <thinitial< th=""> <thi< td=""><td>ample Dup</td></thi<></thinitial<></thinitial<>	ample Dup
InstructionInstruction(C10-C25)Residual Range Organics (RRO)1.601.65mg/L10350 - 150(C25-C36)LCSLCSLCSSurrogate o-Terphenyl%Recovery 85Qualifier 50 - 150Limits 50 - 150n-Triacontane-d628150 - 150Lab Sample ID: LCSD 590-31735/3-A Matrix: Water Analysis Batch: 31736Client Sample ID: Lab Control S Prep B	iample Dup
Residual Range Organics (RRO)1.601.65mg/L10350 - 150(C25-C36)LCSLCSLCSSurrogate o-Terphenyl n-Triacontane-d62%Recovery 85Qualifier 50 - 150Limits 50 - 150Lab Sample ID: LCSD 590-31735/3-A Matrix: Water Analysis Batch: 31736Client Sample ID: Lab Control S Prep B	iample Dup
LCS       LCS       LCS         Surrogate       %Recovery       Qualifier       Limits         o-Terphenyl       85       50 - 150         n-Triacontane-d62       81       50 - 150         Lab Sample ID: LCSD 590-31735/3-A       Client Sample ID: Lab Control S         Matrix: Water       Prep Type         Analysis Batch: 31736       Prep B	iample Dup
Surrogate       %Recovery       Qualifier       Limits         o-Terphenyl       85       50 - 150         n-Triacontane-d62       81       50 - 150         Lab Sample ID: LCSD 590-31735/3-A       Client Sample ID: Lab Control S         Matrix: Water       Prep Type         Analysis Batch: 31736       Prep B	iample Dup
Sundyate     Sundyate       o-Terphenyl     85       n-Triacontane-d62     81       50 - 150       Lab Sample ID: LCSD 590-31735/3-A     Client Sample ID: Lab Control S       Matrix: Water     Prep Type       Analysis Batch: 31736     Prep B	ample Dup
n-Triacontane-d62 81 50 - 150 Lab Sample ID: LCSD 590-31735/3-A Client Sample ID: Lab Control S Matrix: Water Prep Typ Analysis Batch: 31736 Prep B	ample Dup
Lab Sample ID: LCSD 590-31735/3-A Client Sample ID: Lab Control S Matrix: Water Prep Typ Analysis Batch: 31736 Prep B	ample Dup
	e: Total/NA atch: 31735
Spike LCSD LCSD %Rec.	RPD
Analyte Added Result Qualifier Unit D %RecLimits	RPD Limit
Diesel Range Organics (DRO)         1.60         1.44         mg/L         90         50 - 150           (C10-C25)	6 25
Residual Range Organics (RRO)         1.60         1.74         mg/L         109         50 - 150           (C25-C36)	5 25
LCSD_LCSD	
Surrogate %Recovery Qualifier Limits	
o-Terphenyl 80 50 - 150	
n-Triacontane-d62 84 50 - 150	
Lab Sample ID: MB 590-31740/1-A Client Sample ID: Me	thod Blank
Matrix: Solid Prep Typ	e: Iotal/NA
Analysis batch: 31730 Prep B	aicn: 31/40
Analyte Result Qualifier RI MDI Unit D Propared Analyz	ed Dil Fac
Diesel Range Organics (DRO)         ND         10         4.2         mg/Kg         Frepared         Arrayz           (C10, C25)         ND         10         4.2         mg/Kg         05/25/21 16:53         05/25/21 2	20:27 1
Residual Range Organics (RRO) ND 25 5.0 mg/Kg 05/25/21 16:53 05/25/21 2 (C25-C36)	20:27 1
MR MR	
Surrogate SRecovery Qualifier Limits Prenared Δnalvz	ad DUF
	eu LiiFac

QC Sample Results 1												
Client: BGES, Inc. Project/Site: Othello, WA				•					Job ID: 590-15	130-1	2	
Method: NWTPH-Dx - N	orthwest	- S	emi-Vo	latile Petr	oleun	n Produ	cts (GC	) (Continu	ed)			
Lab Sample ID: MB 590-31 Matrix: Solid	740/1-A							Client Samp	le ID: Method Prep Type: Tot	Blank tal/NA		
Analysis Balch: 51750									Ргер Бакси:	31740	5	
		MB	MB								5	
Surrogate	%Reco	75	Qualifier					Prepared	Analyzed	DII Fac		
		75		50 - 750				03/23/21 10.33	03/23/21 20.21	,	· ·	
Lab Sample ID: LCS 590-3 Matrix: Solid	1740/2-A						Clien	t Sample ID:	Lab Control Sa Prep Type: Tot	ample tal/NA	7	
Analysis Batch: 31736									Prep Batch:	31740	8	
				Spike	LCS	LCS			%Rec.			
Analyte				Added	Result	Qualifier		_ <u>D</u> <u>%Rec</u>	Limits		9	
(C10-C25)				00.7	03.7		mg/ng	104	50 - 150			
Residual Range Organics (RRO) (C25-C36)				66.7	75.0		mg/Kg	112	50 - 150			
	LCS	LCS	;									
Surrogate	%Recovery	Qua	lifier	Limits								
o-Terphenyl	88			50 - 150								
n-Triacontane-d62	84			50 - 150								
Lab Sample ID: 590-15130- Matrix: Solid Analysis Batch: 31736	Lab Sample ID: 590-15130-7 DU Client Sample ID: SB1-1-051 Watrix: Solid Prep Type: Total/N. Analysis Batch: 31736 Prep Batch: 3174							-0511 tal/NA 31740				
	Sample	Sam	ple		DU	DU		_		RPD		
Analyte		Qua	lifier		Result	Qualifier		– <u>–</u> – –				
(C10-C25)	ND				ND		iiig/itg	<del>, , ,</del> , , , , , , , , , , , , , , , ,	100	40		
Residual Range Organics (RRO) (C25-C36)	8.3	J			7.72	J	mg/Kg		8	40		
	DU	DU										
Surrogate	%Recovery	Qua	lifier	Limits								
o-Terphenyl	76			50 - 150								
n-Triacontane-d62	67			50 - 150								
Lab Sample ID: 590-15130.	.8 DU							Client Sa	mple ID: SB2-1	-0511		
Matrix: Solid	000							onent ou	Prep Type: Tot	tal/NA		
Analysis Batch: 31736									Prep Batch:	31740		
-	Sample	Sam	ple		DU	DU				RPD		
Analyte	Result	Qua	lifier		Result	Qualifier	Unit	_ <u>D</u>	RPD	Limit		
Diesel Range Organics (DRO)	ND				ND		mg/Kg	¢ —	NC	40		
(CTU-C25) Residual Range Organics (RRO)	6.7	J			8.40	J	ma/Ka	Ċ.	22	40		
(C25-C36)					50	-	6.10					
<b>0</b>	DU	DU		1								
Surrogate	%Recovery	QUA		50 150								
n-Triacontane-d62	74			50 - 150 50 - 150								

#### Method: 6020B - Metals (ICP/MS)

#### Lab Sample ID: MB 580-357165/23-A Matrix: Solid

Analysis Batch: 357347

	MB	MB							
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium	ND		0.40	0.039	mg/Kg		05/22/21 08:19	05/25/21 03:38	5
Chromium	ND		0.50	0.032	mg/Kg		05/22/21 08:19	05/25/21 03:38	5
Lead	ND		0.25	0.024	mg/Kg		05/22/21 08:19	05/25/21 03:38	5
Nickel	ND		0.25	0.097	mg/Kg		05/22/21 08:19	05/25/21 03:38	5
Zinc	ND		2.8	0.81	mg/Kg		05/22/21 08:19	05/25/21 03:38	5

#### Lab Sample ID: LCS 580-357165/24-A Matrix: Solid Analysis Batch: 357347

	Spike	LCS	LCS				%Rec.	
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits	
Cadmium	50.0	52.3		mg/Kg		105	80 - 120	
Chromium	50.0	52.4		mg/Kg		105	80 - 120	
Lead	50.0	49.5		mg/Kg		99	80 - 120	
Nickel	50.0	54.0		mg/Kg		108	80 - 120	
Zinc	50.0	52.1		mg/Kg		104	80 - 120	

#### Lab Sample ID: LCSD 580-357165/25-A Matrix: Solid

Analysis Batch: 357347

Spike	LCSD	LCSD				%Rec.		RPD
Added	Result	Qualifier	Unit	D	%Rec	Limits	RPD	Limit
50.0	52.1		mg/Kg		104	80 - 120	0	20
50.0	52.5		mg/Kg		105	80 - 120	0	20
50.0	49.8		mg/Kg		100	80 - 120	1	20
50.0	53.9		mg/Kg		108	80 - 120	0	20
50.0	51.3		mg/Kg		103	80 - 120	1	20
	Spike           Added           50.0           50.0           50.0           50.0           50.0           50.0           50.0           50.0	Spike         LCSD           Added         Result           50.0         52.1           50.0         52.5           50.0         49.8           50.0         53.9           50.0         51.3	Spike         LCSD         LCSD           Added         Result         Qualifier           50.0         52.1	Spike         LCSD         LCSD           Added         Result         Qualifier         Unit           50.0         52.1         mg/Kg           50.0         52.5         mg/Kg           50.0         49.8         mg/Kg           50.0         53.9         mg/Kg           50.0         53.9         mg/Kg           50.0         51.3         mg/Kg	Spike         LCSD         LCSD           Added         Result         Qualifier         Unit         D           50.0         52.1         mg/Kg         D           50.0         52.5         mg/Kg         D           50.0         49.8         mg/Kg         D           50.0         53.9         mg/Kg         D           50.0         51.3         mg/Kg         D	Spike         LCSD         LCSD           Added         Result         Qualifier         Unit         D         %Rec           50.0         52.1         mg/Kg         104         105           50.0         52.5         mg/Kg         105           50.0         49.8         mg/Kg         100           50.0         53.9         mg/Kg         108           50.0         51.3         mg/Kg         103	Spike         LCSD         %Rec.           Added         Result         Qualifier         Unit         D         %Rec.           50.0         52.1         mg/Kg         D         %Rec.         Limits           50.0         52.5         mg/Kg         104         80-120           50.0         52.5         mg/Kg         100         80-120           50.0         49.8         mg/Kg         100         80-120           50.0         53.9         mg/Kg         108         80-120           50.0         51.3         mg/Kg         103         80-120	Spike         LCSD         %Rec.           Added         Result         Qualifier         Unit         D         %Rec         Limits         RPD           50.0         52.1         mg/Kg         104         80-120         0           50.0         52.5         mg/Kg         105         80-120         0           50.0         52.5         mg/Kg         100         80-120         0           50.0         49.8         mg/Kg         100         80-120         1           50.0         53.9         mg/Kg         108         80-120         0           50.0         51.3         mg/Kg         103         80-120         1

#### Lab Sample ID: MB 580-356842/24-A Matrix: Water Analysis Batch: 356895

MI	3 MB							
Analyte Resu	t Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cadmium NI	<u> </u>	0.0020	0.00019	mg/L		05/18/21 16:33	05/19/21 06:14	5
Chromium NI	)	0.0040	0.00087	mg/L		05/18/21 16:33	05/19/21 06:14	5
Lead NI	)	0.0020	0.00020	mg/L		05/18/21 16:33	05/19/21 06:14	5
Nickel NI	)	0.015	0.00063	mg/L		05/18/21 16:33	05/19/21 06:14	5
Zinc NI	)	0.035	0.0046	mg/L		05/18/21 16:33	05/19/21 06:14	5

#### Lab Sample ID: LCS 580-356842/25-A Matrix: Water Analysis Batch: 356895

Analysis Batch: 356895							Prep Batch: 356842
	Spike	LCS	LCS				%Rec.
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits
Cadmium	1.00	0.978		mg/L		98	80 - 120
Chromium	1.00	1.04		mg/L		104	80 - 120
Lead	1.00	0.992		mg/L		99	80 - 120
Nickel	1.00	1.06		mg/L		106	80 - 120
Zinc	1.00	0.997		mg/L		100	80 - 120

Job ID: 590-15130-1

Prep Type: Total/NA

Prep Batch: 357165

Prep Type: Total/NA

Prep Batch: 357165

**Client Sample ID: Method Blank** 

#### Client Sample ID: Lab Control Sample Dup Prep Type: Total/NA Prep Batch: 357165

**Client Sample ID: Method Blank** 

**Client Sample ID: Lab Control Sample** 

Prep Type: Total Recoverable

**Prep Type: Total Recoverable** 

Prep Batch: 356842

**Client Sample ID: Lab Control Sample** 

#### Job ID: 590-15130-1

## Method: 6020B - Metals (ICP/MS) (Continued)

Lab Sample ID: LCSD 580-356842/26-A Matrix: Water Analysis Batch: 356895			C	Client Sa	ample F	ID: Lab Prep Ty	Control S be: Total I Prep Ba	Sample Recove atch: 38	e Dup erable 56842
	Spike	LCSD	LCSD				%Rec.		RPD
Analyte	Added	Result	Qualifier	Unit	D	%Rec	Limits	RPD	Limit
Cadmium	1.00	0.985		mg/L		98	80 - 120	1	20
Chromium	1.00	1.04		mg/L		104	80 - 120	0	20
Lead	1.00	0.998		mg/L		100	80 - 120	1	20
Nickel	1.00	1.06		mg/L		106	80 - 120	0	20
Zinc	1.00	1.00		mg/L		100	80 - 120	0	20

Initial

Amount

10 mL

10 mL

43 mL

258 mL

80 mL

255.4 mL

261.1 mL

50 mL

50 mL

Dil

1

1

1

1

1

1

1

5

Factor

Run

RA

Prep Type

Total/NA

**Total Recoverable** 

**Total Recoverable** 

#### Client Sample ID: MW1-0511 Date Collected: 05/11/21 12:06 Date Received: 05/13/21 10:00

Batch

Туре

Analysis

Analysis

Analysis

Analysis

Analysis

Analysis

Analysis

Analysis

Prep

Prep

Prep

Prep

Prep

Batch

8260D

8260D

3510C

8011

8011

3510C

8082A

3510C

3005A

6020B

NWTPH-Dx

NWTPH-Gx

8270E SIM

Method

Lab FGS SEA

FGS SEA

TAL SPK

Matrix: Water

#### Lab Sample ID: 590-15130-1 Matrix: Water

Analyst

Prepared

or Analyzed

05/17/21 18:07 RJF

05/18/21 17:57 RJF

05/22/21 01:29 JSP

05/17/21 12:25 NMI

05/17/21 14:28 NMI

05/25/21 13:24 NMI

05/26/21 03:29 NMI

05/16/21 16:29 NMI

05/17/21 16:50 NMI

05/25/21 14:46 NMI

05/25/21 18:22 NMI

05/18/21 16:33 TMH

05/19/21 07:04 FCW

Lab Sample ID: 590-15130-2

Batch

Number

356713

356791

31709

31643

31630

31731

31734

31629

31631

31735

31736

356842

356895

Final

Amount

10 mL

10 mL

43 mL

2 mL

2 mL

2 mL

2 mL

50 mL

50 mL

TAL SPK	
TAL SPK	
FGS SEA	
FGS SEA	

#### Client Sample ID: MW2-0511 Date Collected: 05/11/21 12:19 Date Received: 05/13/21 10:00

_	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Analysis	8260D		1	10 mL	10 mL	356713	05/17/21 18:32	RJF	FGS SEA
Total/NA	Analysis	8260D	RA	1	10 mL	10 mL	356791	05/18/21 18:21	RJF	FGS SEA
Total/NA	Analysis	NWTPH-Gx		1	43 mL	43 mL	31709	05/22/21 02:11	JSP	TAL SPK
Total/NA	Prep	3510C			258.4 mL	2 mL	31643	05/17/21 12:25	NMI	TAL SPK
Total/NA	Analysis	8270E SIM		1			31630	05/17/21 14:51	NMI	TAL SPK
Total/NA	Prep	8011			80 mL	2 mL	31731	05/25/21 13:24	NMI	TAL SPK
Total/NA	Analysis	8011		1			31734	05/26/21 03:45	NMI	TAL SPK
Total/NA	Prep	3510C			256.5 mL	2 mL	31629	05/16/21 16:29	NMI	TAL SPK
Total/NA	Analysis	8082A		1			31631	05/17/21 17:11	NMI	TAL SPK
Total/NA	Prep	3510C			255.2 mL	2 mL	31735	05/25/21 14:46	NMI	TAL SPK
Total/NA	Analysis	NWTPH-Dx		1			31736	05/25/21 18:43	NMI	TAL SPK
Total Recoverable	Prep	3005A			50 mL	50 mL	356842	05/18/21 16:33	ТМН	FGS SEA
Total Recoverable	Analysis	6020B		5	50 mL	50 mL	356895	05/19/21 07:08	FCW	FGS SEA

#### Client Sample ID: MW3-0511 Date Collected: 05/11/21 14:15 Date Received: 05/13/21 10:00

_	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Analysis	8260D		1	10 mL	10 mL	356713	05/17/21 18:56	RJF	FGS SEA
Total/NA	Analysis	8260D	RA	1	10 mL	10 mL	356791	05/18/21 18:46	RJF	FGS SEA
Total/NA	Analysis	NWTPH-Gx		1	43 mL	43 mL	31709	05/22/21 02:33	JSP	TAL SPK
Total/NA	Prep	3510C			234.6 mL	2 mL	31643	05/17/21 12:25	NMI	TAL SPK
Total/NA	Analysis	8270E SIM		1			31630	05/17/21 15:15	NMI	TAL SPK

Eurofins TestAmerica, Spokane

Lab Sample ID: 590-15130-3

Matrix: Water

Initial

Amount

80 mL

220.3 mL

241.1 mL

50 mL

50 mL

Dil

1

1

1

5

Factor

Prep Type

Total/NA

Total/NA

Total/NA

Total/NA

Total/NA

Total/NA

Total Recoverable

**Total Recoverable** 

#### Client Sample ID: MW3-0511 Date Collected: 05/11/21 14:15 Date Received: 05/13/21 10:00

Batch

Туре

Prep

Prep

Prep

Prep

Analysis

Analysis

Analysis

Analysis

Batch

8011

8011

3510C

8082A

3510C

3005A

6020B

NWTPH-Dx

Method

#### Lab Sample ID: 590-15130-3 Matrix: Water

Analyst

Prepared

or Analyzed

05/25/21 13:24 NMI

05/26/21 04:01 NMI

05/16/21 16:29 NMI

05/17/21 17:32 NMI

05/25/21 14:46 NMI

05/25/21 19:03 NMI

05/18/21 16:33 TMH

05/19/21 06:25 FCW

Lab Sample ID: 590-15130-4

Batch

31731

31734

31629

31631

31735

31736

356842

356895

Number

Final

Amount

2 mL

2 mL

2 mL

50 mL

50 mL

8

# Client Sample ID: MW4-0511

Run

Date Collected: 05/11/21 17:16 Date Received: 05/13/21 10:00

	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Analysis	8260D		10	10 mL	10 mL	356713	05/17/21 19:21	RJF	FGS SEA
Total/NA	Analysis	8260D	RA	10	10 mL	10 mL	356791	05/18/21 19:11	RJF	FGS SEA
Total/NA	Analysis	NWTPH-Gx		1	43 mL	43 mL	31709	05/22/21 03:15	JSP	TAL SPK
Total/NA	Prep	3510C			232.6 mL	2 mL	31643	05/17/21 12:25	NMI	TAL SPK
Total/NA	Analysis	8270E SIM		1			31630	05/17/21 15:38	NMI	TAL SPK
Total/NA	Prep	8011			80 mL	2 mL	31731	05/25/21 13:24	NMI	TAL SPK
Total/NA	Analysis	8011		1			31734	05/26/21 04:18	NMI	TAL SPK
Total/NA	Prep	3510C			239.4 mL	2 mL	31629	05/16/21 16:29	NMI	TAL SPK
Total/NA	Analysis	8082A		1			31631	05/17/21 17:52	NMI	TAL SPK
Total/NA	Prep	3510C			230.4 mL	2 mL	31735	05/25/21 14:46	NMI	TAL SPK
Total/NA	Analysis	NWTPH-Dx		1			31736	05/25/21 19:24	NMI	TAL SPK
Total Recoverable	Prep	3005A			50 mL	50 mL	356842	05/18/21 16:33	ТМН	FGS SEA
Total Recoverable	Analysis	6020B		5	50 mL	50 mL	356895	05/19/21 07:11	FCW	FGS SEA

#### **Client Sample ID: Trip Blank** Date Collected: 05/11/21 00:00 Date Received: 05/13/21 10:00

<b>_</b>	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Analysis	8260D		1	10 mL	10 mL	356713	05/17/21 19:46	RJF	FGS SEA
Total/NA	Analysis	8260D	RA	1	10 mL	10 mL	356791	05/18/21 19:36	RJF	FGS SEA
Total/NA	Analysis	NWTPH-Gx		1	43 mL	43 mL	31709	05/22/21 03:36	JSP	TAL SPK

#### **Client Sample ID: Trip Blank** Date Collected: 05/11/21 00:00 Date Received: 05/13/21 10:00

	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Prep	8011			80 mL	2 mL	31731	05/25/21 13:24	NMI	TAL SPK
Total/NA	Analysis	8011		1			31734	05/26/21 04:34	NMI	TAL SPK

Lab

TAL SPK

TAL SPK

TAL SPK

TAL SPK

TAL SPK

TAL SPK

FGS SEA

FGS SEA

Matrix: Water

## Eurofins TestAmerica, Spokane

Lab Sample ID: 590-15130-5

Lab Sample ID: 590-15130-6

Matrix: Water

Matrix: Water

#### Client Sample ID: SB1-1-0511 Date Collected: 05/11/21 09:19 Date Received: 05/13/21 10:00

L	ab Sample	ID: 590 Ma	-15130-7 atrix: Solid	
	Prepared			
er	or Analyzed	Analyst	Lab	5
	05/14/21 08:25	AMB	TAL SPK	
L	ab Sample	ID: 590	-15130-7	
		Ма	atrix: Solid	
	P	ercent S	olids: 79.4	
	Prepared			8

5

	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			31611	05/14/21 08:25	AMB	TAL SPK

#### Client Sample ID: SB1-1-0511 Date Collected: 05/11/21 09:19 Date Received: 05/13/21 10:00

	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Prep	5035			11.314 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	8260D		1	0.86 mL	43 mL	31717	05/24/21 22:34	JSP	TAL SPK
Total/NA	Prep	5035			11.314 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	NWTPH-Gx		1	0.86 mL	43 mL	31715	05/24/21 22:34	JSP	TAL SPK
Total/NA	Prep	3550C			15.18 g	2 mL	31718	05/24/21 11:33	NMI	TAL SPK
Total/NA	Analysis	8270E SIM		1			31723	05/24/21 21:00	NMI	TAL SPK
Total/NA	Prep	8011			10.58 g	2 mL	31728	05/25/21 11:10	NMI	TAL SPK
Total/NA	Analysis	8011		1			31734	05/25/21 22:00	NMI	TAL SPK
Total/NA	Prep	3550C			15.97 g	5 mL	31727	05/25/21 10:45	NMI	TAL SPK
Total/NA	Analysis	8082A		1			31726	05/25/21 14:49	NMI	TAL SPK
Total/NA	Prep	3550C			15.67 g	5 mL	31740	05/25/21 16:53	NMI	TAL SPK
Total/NA	Analysis	NWTPH-Dx		1			31736	05/25/21 21:29	NMI	TAL SPK
Total/NA	Prep	3050B			1.5616 g	50 mL	357165	05/22/21 08:19	JCP	FGS SEA
Total/NA	Analysis	6020B		10	50 mL	50 mL	357347	05/25/21 04:36	FCW	FGS SEA

#### Client Sample ID: SB2-1-0511 Date Collected: 05/11/21 10:14 Date Received: 05/13/21 10:00

Ргер Туре	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			31611	05/14/21 08:25	AMB	TAL SPK

#### Client Sample ID: SB2-1-0511 Date Collected: 05/11/21 10:14 Date Received: 05/13/21 10:00

# Lab Sample ID: 590-15130-8

Lab Sample ID: 590-15130-8

Matrix: Solid

Matrix: Solid

#### Percent Solids: 79.0

	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Prep	5035			11.882 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	8260D		1	0.86 mL	43 mL	31717	05/24/21 22:55	JSP	TAL SPK
Total/NA	Prep	5035			11.882 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	NWTPH-Gx		1	0.86 mL	43 mL	31715	05/24/21 22:55	JSP	TAL SPK
Total/NA	Prep	3550C			15.55 g	2 mL	31718	05/24/21 11:33	NMI	TAL SPK
Total/NA	Analysis	8270E SIM		1			31723	05/24/21 21:27	NMI	TAL SPK
Total/NA	Prep	8011			10.14 g	2 mL	31728	05/25/21 11:10	NMI	TAL SPK
Total/NA	Analysis	8011		1			31734	05/25/21 22:17	NMI	TAL SPK
Total/NA	Prep	3550C			15.41 g	5 mL	31727	05/25/21 10:45	NMI	TAL SPK
Total/NA	Analysis	8082A		1			31726	05/25/21 15:10	NMI	TAL SPK

#### Client Sample ID: SB2-1-0511 Date Collected: 05/11/21 10:14 Date Received: 05/13/21 10:00

Prep Type Total/NA	Batch Type Prep	Batch Method 3550C	Run	Dil Factor	Initial Amount 15.18 g	Final Amount 5 mL	Batch Number 31740	Prepared or Analyzed 05/25/21 16:53	Analyst NMI	Lab TAL SPK
Total/NA Total/NA Total/NA	Analysis Prep Analysis	3050B 6020B		10	1.8998 g 50 mL	50 mL 50 mL	357165 357347	05/22/21 08:19 05/25/21 04:40	JCP FCW	FGS SEA FGS SEA

#### Client Sample ID: SB3-1-0511 Date Collected: 05/11/21 10:22 Date Received: 05/13/21 10:00

	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			31611	05/14/21 08:25	AMB	TAL SPK

#### Client Sample ID: SB3-1-0511 Date Collected: 05/11/21 10:22 Date Received: 05/13/21 10:00

# Lab Sample ID: 590-15130-9

Lab Sample ID: 590-15130-9

```
Matrix: Solid
Percent Solids: 77.3
```

	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Prep	5035			11.71 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	8260D		1	0.86 mL	43 mL	31717	05/24/21 23:17	JSP	TAL SPK
Total/NA	Prep	5035			11.71 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	NWTPH-Gx		1	0.86 mL	43 mL	31715	05/24/21 23:17	JSP	TAL SPK
Total/NA	Prep	3550C			15.42 g	2 mL	31718	05/24/21 11:33	NMI	TAL SPK
Total/NA	Analysis	8270E SIM		2			31723	05/24/21 21:53	NMI	TAL SPK
Total/NA	Prep	8011			10.26 g	2 mL	31728	05/25/21 11:10	NMI	TAL SPK
Total/NA	Analysis	8011		1			31734	05/25/21 22:33	NMI	TAL SPK
Total/NA	Prep	3550C			15.65 g	5 mL	31727	05/25/21 10:45	NMI	TAL SPK
Total/NA	Analysis	8082A		1			31726	05/25/21 15:31	NMI	TAL SPK
Total/NA	Prep	3550C			15.71 g	5 mL	31740	05/25/21 16:53	NMI	TAL SPK
Total/NA	Analysis	NWTPH-Dx		1			31736	05/25/21 22:31	NMI	TAL SPK
Total/NA	Prep	3050B			1.3422 g	50 mL	357165	05/22/21 08:19	JCP	FGS SEA
Total/NA	Analysis	6020B		10	50 mL	50 mL	357347	05/25/21 04:43	FCW	FGS SEA

#### Client Sample ID: SB6-1-0511 Date Collected: 05/11/21 11:39 Date Received: 05/13/21 10:00

Pren Tyne	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Δnalvst	lah
Total/NA	Analysis	Moisture		1	Anount	Amount	31611	05/14/21 08:25	AMB	TAL SPK
<b>Client Sam</b>	ple ID: SB6	6-1-0511					La	b Sample I	D: 590-	15130-10
Date Collecte	d: 05/11/21 1	1:39						-	Ma	atrix: Solid
Date Receive	d: 05/13/21 1	0:00						P	ercent S	olids: 76.9
<b>_</b>	Batch	Batch		Dil	Initial	Final	Batch	Prepared		

	Batch	Batch		ווט	Initiai	Final	Batch	Prepared		
Prep Туре	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Prep	5035			11.909 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	8260D		1	0.86 mL	43 mL	31717	05/24/21 23:38	JSP	TAL SPK

Eurofins TestAmerica, Spokane

Lab Sample ID: 590-15130-10

Lab Sample ID: 590-15130-8

Matrix: Solid

Matrix: Solid

Percent Solids: 79.0

Matrix: Solid

Initial

Amount

11.909 g

0.86 mL

15.50 g

10.08 g

15.85 g

15.68 g

1.1279 g

50 mL

Dil

1

1

1

1

1

10

Factor

Run

Prep Type

Total/NA

#### Client Sample ID: SB6-1-0511 Date Collected: 05/11/21 11:39 Date Received: 05/13/21 10:00

Batch

Туре

Prep

Prep

Prep

Prep

Prep

Prep

Analysis

Analysis

Analysis

Analysis

Analysis

Analysis

Batch

5035

3550C

8011

8011

3550C

8082A

3550C

3050B

6020B

NWTPH-Dx

Method

NWTPH-Gx

8270E SIM

#### Lab Sample ID: 590-15130-10 Matrix: Solid

Analyst

JSP

Prepared

or Analyzed

05/24/21 17:52

05/24/21 23:38 JSP

05/24/21 11:33 NMI

05/24/21 22:19 NMI

05/25/21 11:10 NMI

05/25/21 22:50 NMI

05/25/21 10:45 NMI

05/25/21 15:52 NMI

05/25/21 16:53 NMI

05/25/21 22:52 NMI

05/22/21 08:19 JCP

05/25/21 04:47 FCW

Batch

31722

31715

31718

31723

31728

31734

31727

31726

31740

31736

357165

357347

Number

Final

Amount

10 mL

43 mL

2 mL

2 mL

5 mL

5 mL

50 mL

50 mL

Percent Solids: 76.9

Lab

TAL SPK

FGS SEA

FGS SEA

Matrix: Solid

	5
	8
	ç

#### Client Sample ID: SB8-1-0511 Date Collected: 05/11/21 12:52 Date Received: 05/13/21 10:00

Γ	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Туре	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1		-	31611	05/14/21 08:25	AMB	TAL SPK

#### Client Sample ID: SB8-1-0511 Date Collected: 05/11/21 12:52 Date Received: 05/13/21 10:00

Lab Sample ID:	590-15130-11
-	Matrix: Solid

Lab Sample ID: 590-15130-11

Percent Solids: 77.5

	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Prep	5035			14.915 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	8260D		1	0.86 mL	43 mL	31717	05/25/21 00:00	JSP	TAL SPK
Total/NA	Prep	5035			14.915 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	NWTPH-Gx		1	0.86 mL	43 mL	31715	05/25/21 00:00	JSP	TAL SPK
Total/NA	Prep	3550C			15.97 g	2 mL	31718	05/24/21 11:33	NMI	TAL SPK
Total/NA	Analysis	8270E SIM		1			31723	05/24/21 22:45	NMI	TAL SPK
Total/NA	Prep	8011			10.22 g	2 mL	31728	05/25/21 11:10	NMI	TAL SPK
Total/NA	Analysis	8011		1			31734	05/25/21 23:06	NMI	TAL SPK
Total/NA	Prep	3550C			15.31 g	5 mL	31727	05/25/21 10:45	NMI	TAL SPK
Total/NA	Analysis	8082A		1			31726	05/25/21 16:13	NMI	TAL SPK
Total/NA	Prep	3550C			15.74 g	5 mL	31740	05/25/21 16:53	NMI	TAL SPK
Total/NA	Analysis	NWTPH-Dx		1			31736	05/25/21 23:13	NMI	TAL SPK
Total/NA	Prep	3050B			1.4270 g	50 mL	357165	05/22/21 08:19	JCP	FGS SEA
Total/NA	Analysis	6020B		10	50 mL	50 mL	357347	05/25/21 04:51	FCW	FGS SEA

Initial

Amount

Final

Amount

Dil

1

Factor

Run

Prep Type

Total/NA

#### Client Sample ID: SB10-1-0511 Date Collected: 05/11/21 13:05 Date Received: 05/13/21 10:00

Batch

Туре

Client Sample ID: SB10-1-0511

Analysis

Batch

Method

Moisture

Lab Sample ID: 590-15130-12 Matrix: Solid										
Batch	Prepared									
Number	or Analyzed	Analyst	Lab	5						
31611	05/14/21 08:25	AMB	TAL SPK							
La	b Sample II	D: 590-	15130-12							
		Ма	atrix: Solid							
	Р	ercent S	olids: 76.1							
Batch	Prepared			8						
Number	or Analyzed	Analyst	Lab							

Job ID: 590-15130-1

Date Collecte	ate Collected: 05/11/21 13:05 ate Received: 05/13/21 10:00										
	Batch	Batch	Dura	Dil	Initial	Final	Batch	Prepared	Amahuat	Lak	
	Туре		Run	Factor	Amount	Amount		or Analyzed	Analyst		
Iotal/NA	Prep	5035			14.459 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK	
Total/NA	Analysis	8260D		1	0.86 mL	43 mL	31717	05/25/21 00:22	JSP	TAL SPK	
Total/NA	Prep	5035			14.459 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK	
Total/NA	Analysis	NWTPH-Gx		1	0.86 mL	43 mL	31715	05/25/21 00:22	JSP	TAL SPK	
Total/NA	Prep	3550C			15.59 g	2 mL	31718	05/24/21 11:33	NMI	TAL SPK	
Total/NA	Analysis	8270E SIM		1			31723	05/24/21 23:12	NMI	TAL SPK	
Total/NA	Prep	8011			10.47 g	2 mL	31728	05/25/21 11:10	NMI	TAL SPK	
Total/NA	Analysis	8011		1			31734	05/25/21 23:23	NMI	TAL SPK	
Total/NA	Prep	3550C			15.73 g	5 mL	31727	05/25/21 10:45	NMI	TAL SPK	
Total/NA	Analysis	8082A		1			31726	05/25/21 16:34	NMI	TAL SPK	
Total/NA	Prep	3550C			15.90 g	5 mL	31740	05/25/21 16:53	NMI	TAL SPK	
Total/NA	Analysis	NWTPH-Dx		1			31736	05/25/21 23:34	NMI	TAL SPK	
Total/NA	Prep	3050B			1.4038 g	50 mL	357165	05/22/21 08:19	JCP	FGS SEA	
Total/NA	Analysis	6020B		10	50 mL	50 mL	357347	05/25/21 04:55	FCW	FGS SEA	

#### Client Sample ID: SB13-1-0511 Date Collected: 05/11/21 14:35 Date Received: 05/13/21 10:00

	Ргер Туре	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
L	Total/NA	Analysis	Moisture		1			31611	05/14/21 08:25	AMB	TAL SPK

#### Client Sample ID: SB13-1-0511 Date Collected: 05/11/21 14:35 Date Received: 05/13/21 10:00

Lab Sample ID: 590-15130-13

Matrix: Solid

#### Lab Sample ID: 590-15130-13 Matrix: Solid Percent Solids: 77.3

	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Prep	5035			12.434 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	8260D		1	0.86 mL	43 mL	31717	05/25/21 00:43	JSP	TAL SPK
Total/NA	Prep	5035			12.434 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	NWTPH-Gx		1	0.86 mL	43 mL	31715	05/25/21 00:43	JSP	TAL SPK
Total/NA	Prep	3550C			15.83 g	2 mL	31718	05/24/21 11:33	NMI	TAL SPK
Total/NA	Analysis	8270E SIM		1			31723	05/24/21 23:38	NMI	TAL SPK
Total/NA	Prep	8011			10.60 g	2 mL	31728	05/25/21 11:10	NMI	TAL SPK
Total/NA	Analysis	8011		1			31734	05/25/21 23:39	NMI	TAL SPK
Total/NA	Prep	3550C			15.26 g	5 mL	31727	05/25/21 10:45	NMI	TAL SPK
Total/NA	Analysis	8082A		1			31726	05/25/21 16:55	NMI	TAL SPK

### Client Sample ID: SB13-1-0511 Date Collected: 05/11/21 14:35 Date Received: 05/13/21 10:00

	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Prep	3550C			15.64 g	5 mL	31740	05/25/21 16:53	NMI	TAL SPK
Total/NA	Analysis	NWTPH-Dx		1			31736	05/26/21 00:15	NMI	TAL SPK
Total/NA	Prep	3050B			1.5592 g	50 mL	357165	05/22/21 08:19	JCP	FGS SEA
Total/NA	Analysis	6020B		10	50 mL	50 mL	357347	05/25/21 04:59	FCW	FGS SEA

#### Client Sample ID: SB15-1-0511 Date Collected: 05/11/21 14:47 Date Received: 05/13/21 10:00

	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			31611	05/14/21 08:25	AMB	TAL SPK

#### Client Sample ID: SB15-1-0511 Date Collected: 05/11/21 14:47 Date Received: 05/13/21 10:00

_	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Prep	5035			15.406 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	8260D		1	0.86 mL	43 mL	31717	05/25/21 01:05	JSP	TAL SPK
Total/NA	Prep	5035			15.406 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	NWTPH-Gx		1	0.86 mL	43 mL	31715	05/25/21 01:05	JSP	TAL SPK
Total/NA	Prep	3550C			15.25 g	2 mL	31718	05/24/21 11:33	NMI	TAL SPK
Total/NA	Analysis	8270E SIM		1			31723	05/25/21 00:04	NMI	TAL SPK
Total/NA	Prep	8011			10.15 g	2 mL	31728	05/25/21 11:10	NMI	TAL SPK
Total/NA	Analysis	8011		1			31734	05/25/21 23:56	NMI	TAL SPK
Total/NA	Prep	3550C			15.77 g	5 mL	31727	05/25/21 10:45	NMI	TAL SPK
Total/NA	Analysis	8082A		1			31726	05/25/21 17:17	NMI	TAL SPK
Total/NA	Prep	3550C			15.51 g	5 mL	31740	05/25/21 16:53	NMI	TAL SPK
Total/NA	Analysis	NWTPH-Dx		1			31736	05/26/21 00:36	NMI	TAL SPK
Total/NA	Prep	3050B			1.3197 g	50 mL	357165	05/22/21 08:19	JCP	FGS SEA
Total/NA	Analysis	6020B		10	50 mL	50 mL	357347	05/25/21 05:45	FCW	FGS SEA

#### Client Sample ID: SB18-1-0511 Date Collected: 05/11/21 16:18 Date Received: 05/13/21 10:00

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			31611	05/14/21 08:25	AMB	TAL SPK
<b>Client Sam</b>	ple ID: SB1	18-1-0511					La	b Sample I	D: 590-	15130-15
<b>Date Collecte</b>	ed: 05/11/21 1	6:18							M	atrix: Solid
Date Receive	d: 05/13/21 1	0:00						Р	ercent S	olids: 97.5
Γ	Batch	Batch		Dil	Initial	Final	Batch	Prepared		

	Datch	Batch		ווט	initiai	rinai	Datch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Prep	5035			9.303 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	8260D		1	0.86 mL	43 mL	31717	05/25/21 01:27	JSP	TAL SPK

Eurofins TestAmerica, Spokane

Lab Sample ID: 590-15130-15

Job ID: 590-15130-1

## Lab Sample ID: 590-15130-13 Matrix: Solid

Lab Sample ID: 590-15130-14

Lab Sample ID: 590-15130-14

Percent Solids: 77.3

Matrix: Solid

Matrix: Solid

Percent Solids: 79.0

8

Page 79 of 89

Matrix: Solid

Initial

Amount

9.303 g

0.86 mL

15.43 g

10.26 g

15.37 g

15.52 g

1.3071 g

50 mL

Dil

1

1

1

1

1

10

Factor

Run

Prep Type

Total/NA

#### Client Sample ID: SB18-1-0511 Date Collected: 05/11/21 16:18 Date Received: 05/13/21 10:00

Batch

Туре

Prep

Prep

Prep

Prep

Prep

Prep

Analysis

Analysis

Analysis

Analysis

Analysis

Analysis

Batch

5035

3550C

8011

8011

3550C

8082A

3550C

3050B

6020B

NWTPH-Dx

Method

NWTPH-Gx

8270E SIM

#### Lab Sample ID: 590-15130-15 Matrix: Solid

Analyst

JSP

Prepared

or Analyzed

05/24/21 17:52

05/25/21 01:27 JSP

05/24/21 11:33 NMI

05/25/21 00:30 NMI

05/25/21 11:10 NMI

05/26/21 00:28 NMI

05/25/21 10:45 NMI

05/25/21 17:38 NMI

05/25/21 16:53 NMI

05/26/21 00:56 NMI

Batch

31722

31715

31718

31723

31728

31734

31727

31726

31740

31736

357165

357347

Number

Final

Amount

10 mL

43 mL

2 mL

2 mL

5 mL

5 mL

50 mL

50 mL

Percent Solids: 97.5

Lab

TAL SPK

Matrix: Solid

	5
_	
	8
	9

10

# 55 05/22/21 08:19 JCP FGS SEA 47 05/25/21 05:52 FCW FGS SEA Lab Sample ID: 590-15130-16

#### Client Sample ID: SB20-1-0511 Date Collected: 05/11/21 16:50 Date Received: 05/13/21 10:00

	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1		-	31611	05/14/21 08:25	AMB	TAL SPK

#### Client Sample ID: SB20-1-0511 Date Collected: 05/11/21 16:50 Date Received: 05/13/21 10:00

#### Lab Sample ID: 590-15130-16 Matrix: Solid Percent Solids: 92.4

	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Туре	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Prep	5035			9.97 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	8260D		1	0.86 mL	43 mL	31717	05/25/21 01:48	JSP	TAL SPK
Total/NA	Prep	5035			9.97 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	NWTPH-Gx		1	0.86 mL	43 mL	31715	05/25/21 01:48	JSP	TAL SPK
Total/NA	Prep	3550C			15.57 g	2 mL	31718	05/24/21 11:33	NMI	TAL SPK
Total/NA	Analysis	8270E SIM		1			31723	05/25/21 00:57	NMI	TAL SPK
Total/NA	Prep	8011			10.35 g	2 mL	31728	05/25/21 11:12	NMI	TAL SPK
Total/NA	Analysis	8011		1			31734	05/26/21 01:18	NMI	TAL SPK
Total/NA	Prep	3550C			15.25 g	5 mL	31727	05/25/21 10:45	NMI	TAL SPK
Total/NA	Analysis	8082A		1			31726	05/25/21 17:59	NMI	TAL SPK
Total/NA	Prep	3550C			15.95 g	5 mL	31740	05/25/21 16:53	NMI	TAL SPK
Total/NA	Analysis	NWTPH-Dx		1			31736	05/26/21 01:17	NMI	TAL SPK
Total/NA	Prep	3050B			1.4209 g	50 mL	357165	05/22/21 09:07	JCP	FGS SEA
Total/NA	Analysis	6020B		10	50 mL	50 mL	357347	05/25/21 05:41	FCW	FGS SEA

Ргер Туре

Total/NA

#### Client Sample ID: SB20-2-0511 Date Collected: 05/11/21 16:50 **Date Recei**

Lat	15130-17 atrix: Solid		
ı	Prepared		
ber	or Analyzed	Analyst	Lab
	05/14/21 08:25	AMB	TAL SPK

Matrix: Solid

Percent Solids: 92.3

#### Lab Sample ID: 590 Ν

iveo	d: 05/13/21 1	0:00								
	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	
	Analysis	Moisture		1			31611	05/14/21 08:25	AMB	

#### Client Sample ID: SB20-2-0511 Date Collected: 05/11/21 16:50 Date Received: 05/13/21 10:00

Analysis

Moisture

	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Prep	5035			9.097 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	8260D		1	0.86 mL	43 mL	31717	05/25/21 02:31	JSP	TAL SPK
Total/NA	Prep	5035			9.097 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	NWTPH-Gx		1	0.86 mL	43 mL	31715	05/25/21 02:31	JSP	TAL SPK
Total/NA	Prep	3550C			15.95 g	2 mL	31718	05/24/21 11:33	NMI	TAL SPK
Total/NA	Analysis	8270E SIM		1			31723	05/25/21 01:23	NMI	TAL SPK
Total/NA	Prep	8011			10.76 g	2 mL	31728	05/25/21 11:12	NMI	TAL SPK
Total/NA	Analysis	8011		1			31734	05/26/21 01:34	NMI	TAL SPK
Total/NA	Prep	3550C			15.32 g	5 mL	31727	05/25/21 10:45	NMI	TAL SPK
Total/NA	Analysis	8082A		1			31726	05/25/21 18:20	NMI	TAL SPK
Total/NA	Prep	3550C			15.41 g	5 mL	31740	05/25/21 16:53	NMI	TAL SPK
Total/NA	Analysis	NWTPH-Dx		1			31736	05/26/21 01:38	NMI	TAL SPK
Total/NA	Prep	3050B			1.2001 g	50 mL	357165	05/22/21 08:19	JCP	FGS SEA
Total/NA	Analysis	6020B		10	50 mL	50 mL	357347	05/25/21 05:49	FCW	FGS SEA

#### **Client Sample ID: Trip Blank** Date Collected: 05/11/21 00:00 Date Received: 05/13/21 10:00

#### Lab Sample ID: 590-15130-18 Matrix: Solid

-	Batch	Batch		Dil	Initial	Final	Batch	Prepared		
Prep Type	Туре	Method	Run	Factor	Amount	Amount	Number	or Analyzed	Analyst	Lab
Total/NA	Prep	5035			10.155 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	8260D		1	0.86 mL	43 mL	31717	05/25/21 02:53	JSP	TAL SPK
Total/NA	Prep	5035			10.155 g	10 mL	31722	05/24/21 17:52	JSP	TAL SPK
Total/NA	Analysis	NWTPH-Gx		1	0.86 mL	43 mL	31715	05/25/21 02:53	JSP	TAL SPK

Laboratory References:

FGS SEA = Eurofins FGS, Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

TAL SPK = Eurofins TestAmerica, Spokane, 11922 East 1st Ave, Spokane, WA 99206, TEL (509)924-9200

Job ID: 590-15130-1

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#### Laboratory: Eurofins TestAmerica, Spokane Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below. Authority Program **Identification Number Expiration Date** Washington C569 01-06-22 State The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification. Analysis Method Prep Method Matrix Analyte Percent Moisture Moisture Solid Moisture Solid Percent Solids NWTPH-Dx 3510C Residual Range Organics (RRO) (C25-C36) Water NWTPH-Dx 3550C Solid Residual Range Organics (RRO) (C25-C36) Laboratory: Eurofins FGS, Seattle The accreditations/certifications listed below are applicable to this report. Authority Identification Number Program **Expiration Date** Washington State C788 07-13-21
# Method Summary

Method

8260D

8260D

8011

8082A

6020B

3005A

3050B

3510C

3550C

3665A

5030B

5030C

5035

8011

Moisture

NWTPH-Gx

8270E SIM

NWTPH-Dx

TAL SPK

TAL SPK

Protocol

SW846

SW846

NWTPH

SW846

SW846

SW846

NWTPH

SW846

EPA

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D: 590-15130-1	
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TAL ODV	
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TAL SPK	5
TAL SPK	
FGS SEA	
TAL SPK	
FGS SEA	8
FGS SEA	
TAL SPK	9
TAL SPK	
TAL SPK	10
FGS SEA	
TAL SPK	

### **Protocol References:**

EPA = US Environmental Protection Agency

**Method Description** 

Metals (ICP/MS)

Percent Moisture

Preparation, Metals

Ultrasonic Extraction

Purge and Trap

Purge and Trap

Microextraction

Volatile Organic Compounds by GC/MS

Volatile Organic Compounds by GC/MS

EDB, DBCP, and 1,2,3-TCP (GC)

Northwest - Volatile Petroleum Products (GC/MS)

Northwest - Semi-Volatile Petroleum Products (GC)

Preparation, Total Recoverable or Dissolved Metals

Liquid-Liquid Extraction (Separatory Funnel)

Sulfuric Acid/Permanganate Cleanup

Closed System Purge and Trap

Polychlorinated Biphenyls (PCBs) by Gas Chromatography

Semivolatile Organic Compounds (GC/MS SIM)

NWTPH = Northwest Total Petroleum Hydrocarbon

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

#### Laboratory References:

FGS SEA = Eurofins FGS, Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310 TAL SPK = Eurofins TestAmerica, Spokane, 11922 East 1st Ave, Spokane, WA 99206, TEL (509)924-9200

Eurofins TestAmerica, Spokane																				\$		ł				
Spokane. WA 99206 Phone (509) 924-9200 Phone (509) 924-9290		Chain c	of Cus	tody R	ec	orc	<u> 1</u>													() ()	uro	TINS	AE	vironm terica	ent Tes	ting
Client Information	Sampler: 2052	Polloc		Lab P Arrin	gton.	Ran	dee						Ca	Tier T	ackin	g No(s	÷			590-	No:	-1015	-			
Gient Contact Rose Pollock	Phone: 206 · 3	04-79	96	E-Mai Rano	lee.A	rring	tona	Ēur	ofins	et.co	3		Sta	te of (	Drigin:	Ξ				Page		S				
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			Sample Type	Matrix (w=water,	litered :	- Cd, Cr, I	I-Dx - DR	- Volatile	EDB	Cd. Cr. I	LL - Vola	PCBs - S	SIM - Pol	Dx - DR	-Gx - GR	TPH	00 D		lumber							
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MW3-0511	5/11/21	1415	6	N Solid DO	2				~	×	×	$\star$	$\times$	×	*.				(j)							
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Total Number Special Instructions/Note:	8260	NWTPH	NWTPH-Gx - GI	8270E_SIM - Po	8082A - PCBs -	6020B - Cd, Cr, 8260D_LL - Vol	8011 - EDB	8260D - Volatile	6020B - Cd, Cr, NWTPH-Dx - DI	Perform MS/A	Field Filtered	Matrix (Www.ater S=solid. ), Oww.astelid. ), BT=Tissue, A=	Sample Type (C=comp G=grab)	Sample Time	ple Date	Sam					cation	Identifi	Sample
of cor Other:	D	-61	RO and	RO and	Standa	Pb, Ni, atiles, s		es, stan	Pb, Ni,	18D (Y	Samp					SSOW			ځ	noper	S P	Lima	Site:
L - EDA Z - other (specify)		(- (		c Aron	rd Lis	Zn standa		dard li	Zn RO	es or	e (Ye				# 1146	Project 59002						WA	Project Na Othello,
J - DI Water V - MCAA	_	ARC		natic H	1	rd list,		st & N		No	s or N					WO #					öm	gesinc.c	rose@b
G - Amchlor S - H2SO4 H - Ascorbic Acid T - TSP Dodecahydrate		2		ydroca		low le		WTPH-		. *	0)		ed	r not requir	ase Orde	PO #:					el)	-4554(T	206-569
E - NaHSO4 Q - Na2SO3				rbons		vel		Gx - 0		0	Ц		A No	ct: ∆ Yes	ance Proje	Compli						166	WA, 981
C - Zn Acetate O - ASNaO2				;				RO		°° a"				tays):	quested (d	TAT Re							State Zin:
Preservation Codes:								-		-				ted	nte Request	Due Da			00-267	uite C10	street S	148th \$	Address: 126 SW
Job #:			ă	ueste	Requ	alysis	Ana						PWSID:									nc.	BGES, I
Page: Page 2 of 🗲 🎗		¥ A	Origin:	State of		m	inset.c	)Eurofi	gton@	.Arrin	-Mail:	ט ת ת	7956	304.	206-	Phone:						ollock	Rose Po
COC No: 590-6442-1915.2		) No(s):	Tracking	Carrier 1				nu -	ndee E	on, Ra	ab PM:	A	ock	Poll	Rose	Sample					nation	Inforn	Client
Carter Content									ġ	Cor	Re	stody	of Cu	Chain				<b>okane</b> 4-9290	a, Spo 509) 92	Phone ()	<b>estAr</b> Ave 99206 4-9200	ast 1st e, WA 509) 92	11922 E Spokane Phone ()
															11	10	8	7	6	5	4	3	2

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Date:

Date/Time:

Company Company Company

Received by:

Date/Time Date/ Date/Time Time

Company Company Company

Cooler Temperature(s) °C and Other Remarks

 $\frown$ 

Custody Seals Intact: ∆ Yes ∆ No

Custody Seal No.:

#### **Eurofins TestAmerica, Spokane** 11922 East 1st Ave

# Chain of Custody Record



🔅 eurofins

Environment Testing America

Spokane, WA 99206 Phone: 509-924-9200 Fax: 509-924-9290

Client Information (Sub Contract Lab)	Sampler:			Lab	PM: inato	n. Ra	ande	еE					Carri	er Tra	cking N	o(s):			COC No: 590-5986 1	
Client Contact:	Phone:			E-N	lail:			- @F					State	of Ori	gin:				Page:	
Company:	l			rta	Acc	.Amr redita	tions	Require	ronn ed (Se	set.co	981 );		Ivvas	ning	ion		,.,		Job #:	
Eurofins Frontier Global Sciences LLC	Due Date Desure				Sta	ite - 1	Was	hingto	n										590-15130-1	
5755 8th Street East,	5/26/2021	tea:								Ana	lysis	s Re	ques	ted					Preservation	Codes:
City: Tacoma	TAT Requested (c	lays):						list	ž						Т				B - NaOH	M - Hexane N - None
State. Zip:							level	alyte	alyte		ĺ								D - Nitric Acid	0 - AsNaO2 P - Na2O4S
VVA, 98424 Phone:	PO #:				-		low	ug an	ng an										E - NaHSO4 F - MeOH	Q - Na2SO3 R - Na2S2O3
253-922-2310(Tel) 425-420-9210(Fax)							퇴	in in its											G - Amchior H - Ascorbic Aci	S - H2SO4 d T - TSP Dodecahydrate
Emain:	WO #:				8	<u>e</u>	andai	fort											I - Ice J - DI Water	U ~ Acetone V - MCAA
Project Name: Othello, WA	Project #: 59002146				18	s or 1	es, st	nplate	biate		ĺ							alner	K - EDTA L - EDA	W - pH 4-5 Z - other (specify)
Site:	SSOW#:					2	datte	Ten (1										tuo s	Other:	
		<del></del>	<b>1</b>								ĺ							10		
			Sample	Matrix	tere	5	120	05A						ĺ				mbe		
		Sample	iype (C≕comp,	S=solid, C=wastn/oil,	ER			08/3										al Ni		
Sample Identification - Client ID (Lab ID)	Sample Date	Time	G=grab)	BT=Thsue, A=Ar		â		602		-	us kosker	8 34450	100000000	1000000		21241 <b>9</b> 2535	68560 (38 <u>4</u> 55	2	Special	Instructions/Note:
NIN 1 0511 (500 15120 1)		12:06	Preserva	uon Code:	¥	× .									1			X		
(100-1013) ( (000-10130-1)		Pacific		Water	+	1	×	×			1	<b> </b>						4		
MW-2-0511 (590-15130-2)	5/11/21	Pacific		Water			×	x										4		
MW-3-0511 (590-15130-3)	5/11/21	14:15 Pacific		Water		:	×   .	x										4		
MW-4-0511 (590-15130-4)	5/11/21	17:16 Pacific		Water	TT	;	X I	x										4		
Trip Blank (590-15130-5)	5/11/21	Pacific		Water	11	;	x		-		1		+				-	2		
SB1-1-0511 (590-15130-7)	5/11/21	09:19 Pacific		Solid		T		×		~	1				+	+	-	1		
SB2-1-0511 (590-15130-8)	5/11/21	10:14 Pacific		Solid		1		x	:		1							1		
SB3-1-0511 (590-15130-9)	5/11/21	10:22 Pacific		Solid				×			1			$\uparrow$	+	1		1		
SB6-1-0511 (590-15130-10)	5/11/21	11:39 Pacific		Solid		1		x	:	1	1							1		
Note: Since laboratory accreditations are subject to change, Eurofins TestAm	erica places the ownershi	o of method, ar	alyte & accredi	tation complia	nce up	on ou	t subc	contract	t labor	ratories	. This	sampi	e shipn	nent is	forwar	ded ur	nder ch	nain-of-	-custody. If the lab	oratory does not currently
maintain accreditation in the State of Origin listed above for analysis/tests/ma TestAmerica attention immediately. If all requested accreditations are current	rix being analyzed, the sa to date, return the signed	mples must be Chain of Cust	shipped back I ody attesting to	to the Eurofins said complica	TestA	meric: Eurofi	a labo ins Te	oratory estAme	or oth rica.	er instr	uctions	s will b	e provid	led. A	ny cha	nges t	o accre	editatio	on status should be	brought to Eurofins
Possible Hazard Identification					Īs	amp	le D	íspos	al ()	A fee	mav	be as	sess	ed if	sami	des a	are re	taine	d longer than	1 month)
Unconfirmed						Ó	Retu	um To	) Clie	ent	ן נ	$\square_D$	isposi	al By	Lab			Arch	ive For	Months
Deliverable Requested: I, II, III, IV, Other (specify)	Primary Delivera	ble Rank: 2			S	pecia	al Ins	structi	ons/(	QC R	equire	emen	ts:							
Empty Kit Relinquished by:		Date:			Time		~						N	ethod	of Ship	ment:				
Relinquished by: MM/M/M MDDU	Date/Time;	mule	C	ompany		Re	Ceive	N	$\overline{\gamma}$						Da	te/Tin	e:	5	100	Company
Relinquished by:	Date/Time:	19.10	с	ompany		Re	ceived	d by							Da	≥ I le/Tim	e:			Company
Relinquished by:	Date/Time:		c	ompany	·····	Re	ceived	d by:							Dai	e/Tim	e:			Company
Custody Seals Intact: Custody Seal No.:		n de la coltra	san daga	1.1.191.1.1		Co	oler T	empera	ature(s	s)°Ca	nd Oth	er Ren	arks:		l Ngay	N N N	1946.3		a a transfer e tr	
Δ Yes Δ No	· · · ·	n i ng garik. Ma	vereigi (d. 1	Banne	<del></del>	. مام		3.55	A	1	•	2025		113 A.		NeV (				<u> </u>
				гауес	1	på	:	1.	7	\$								_		Ver: 11/01/20/201

### Eurofins TestAmerica, Spokane

# **Chain of Custody Record**

11922 East 1st Ave Spokane, WA 99206 · 600 024 0200

Client Information (Sub Contract Lab)	Sampler:			Lab P Arrin	M: aton	Ran	dee E				T	Carrier	fracking	) No(s):			COC No: 590-5986.2	
Client Contact:	Phone:			E-Ma	il: dan A			E. mol	incot or			State of	Origin:				Page: Page: 2 of 2	
Shipping/Receiving Company:				Ran	Accred	titatio	ns Req	uired (	See note	): ):	I	Wash	ngtun				Job #:	
Eurofins Frontier Global Sciences LLC	Due Date Request	and.			State	- W	ashin	gton						· ·			590-15130-1 Breservation Cor	tas:
5755 8th Street East,	5/26/2021								Ana	lysis	Req	ueste	d				A ~ HCL	M - Hexane
City: Tacoma	TAT Requested (d	ays):					e list	e list									B - NaOH C - Zn Acetate	N - None O - AsNaO2
State, Zip:						v feve	Inalyti	nalyt									D - Nitric Acid E - NaHSO4	P - Na2O4S Q - Na2SO3
Phone:	PO #:		<b></b>			st, lov	a guis	Aing a				1					F - MeOH G - Amchior	R - Na2S2O3 S - H2SO4
253-922-2310(Tel) 425-420-9210(Fax)					(ON	ard II	- pull	L built									H - Ascorbic Acid	T - TSP Dodecahydra U - Acetone
	Contract H				No)	stand	ate for	ate fo								613	J - DI Water K - EDTA	V - MCAA W - pH 4-5
Project Name: Othello, WA	59002146				le (Yi es ol	üles,	empta	empla								ntain	L - EDA	Z - other (specify)
Site:	SSOW#:				due Q	Vola	1 (ac	L (ac								of co	Other:	
Sample identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	<b>latrîx</b> V=water, L=solid, wsste/oit, saue, A=Air)	Field Filtered S Perform MS/MI	82600_LL/5030B	6020B/3005A (Me	6020B/3050B (M(								Total Number	Special In	structions/Note:
	$\sim$	$\times$	Preservation	Code:	XX											X		
SB8-1-0511 (590-15130-11)	5/11/21	12:52 Pacific		Solid				x								1		
SB10-1-0511 (590-15130-12)	5/11/21	13:05 Pacific		Solid				x								1		
SB13-1-0511 (590-15130-13)	5/11/21	14:35 Pacific		Solid		T	T	X								1		
SB15-1-0511 (590-15130-14)	5/11/21	14:47 Pacific		Solid				x								1		
SB18-1-0511 (590-15130-15)	5/11/21	16:18 Pacific		Solid				x								1		
SB20-1-0511 (590-15130-16)	5/11/21	16:50 Pacific		Solid				x								1		
SB20-2-0511 (590-15130-17)	5/11/21	16:50 Pacific		Solid				X								1		
																_		
																	1	<u></u>
Note: Since laboratory accreditations are subject to change. Eurofins Tes maintain accreditation in the State of Origin listed above for analysis/tests TestAmerica attention immediately. If all requested accreditations are cu	tAmerica places the ownershi s/matrix being analyzed, the sa ment to date, return the signed	p of method, an amples must be d Chain of Custo	alyte & accreditatio shipped back to the dy attesting to said	n compliar e Eurofins complicar	rce upor TestAm rce to E	n out s ierica urofin	subcon laborat s Test/	tract la ory or Americ	iboratorie other inst a.	s. This : ructions	sample will be	shipme provide	nt is for 1. Any i	warded changes	under o s to acc	chain-of- reditatio	-custody. If the labora on status should be br	itory does not currently ought to Eurofins
Possible Hazard Identification					Sa	mple	e Disj	oosa	( A fee	may l	be as:	sesse	d if sa	mples	are i	etaine	ed longer than 1	month)
Unconfirmed	Driverny Daliver	able Beeks 3				F	Return	To (	Client		' Dis	posal	By La	b	<u> </u>	Arch	nive For	Months
Deliverable Requested: I. II, III, IV, Other (specify)	Pilmary Delivera				30	eciai	man			vequile				~	·			
Empty Kit Relinquished by:	là th Circo	Date:	10 and		Time:	ID.Z	<u>a</u>	<u></u>				Me	nod of	Shipmei	nt:	<u> </u>		Company
Relinquished by: MANULIONU	Date/Time:	14)	YU Com	ASPL	/	Rece		ŗД						Date/T	15	<u>p1</u>	1009	Company Company
Relinquished by:	Date/Time:		Come	any		Rece	eived b	<u>y:</u>						Date/Ti	me:			Company
				-		ļ			0					L	No. 2014			<u> </u>
Custody Seals Intact: Custody Seal No.:		같이 안가 ? 같이 안가 ?	가 10년 7월 18일 19일			Cool	er Tem	peratu	ire(s) °C a	and Othe	er Rema	irks:						
· · · · · · · · · · · · · · · · · · ·			Р	age 8	7 of	89		ı.Ć	57	•								Ver: 16/21/202

## Login Sample Receipt Checklist

Client: BGES, Inc.

### Login Number: 15130 List Number: 1 Creator: O'Toole, Maria C

Question	Answer	Comment
Radioactivity wasn't checked or is = background as measured by a survey meter.</td <td>N/A</td> <td>Lab does not accept radioactive samples.</td>	N/A	Lab does not accept radioactive samples.
The cooler's custody seal, if present, is intact.	True	152648/1526480
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	No analysis requiring residual chlorine check assigned.

List Source: Eurofins TestAmerica, Spokane

## Login Sample Receipt Checklist

Client: BGES, Inc.

#### Login Number: 15130 List Number: 2 Creator: Presley, Kim A

Question	Answer	Comment
Radioactivity wasn't checked or is = background as measured by a survey meter.</td <td>N/A</td> <td></td>	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	IR9=1.0c/0.8c
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	Received project as a subcontract.
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Job Number: 590-15130-1

List Source: Eurofins FGS, Seattle

List Creation: 05/15/21 01:51 PM